Electrical World

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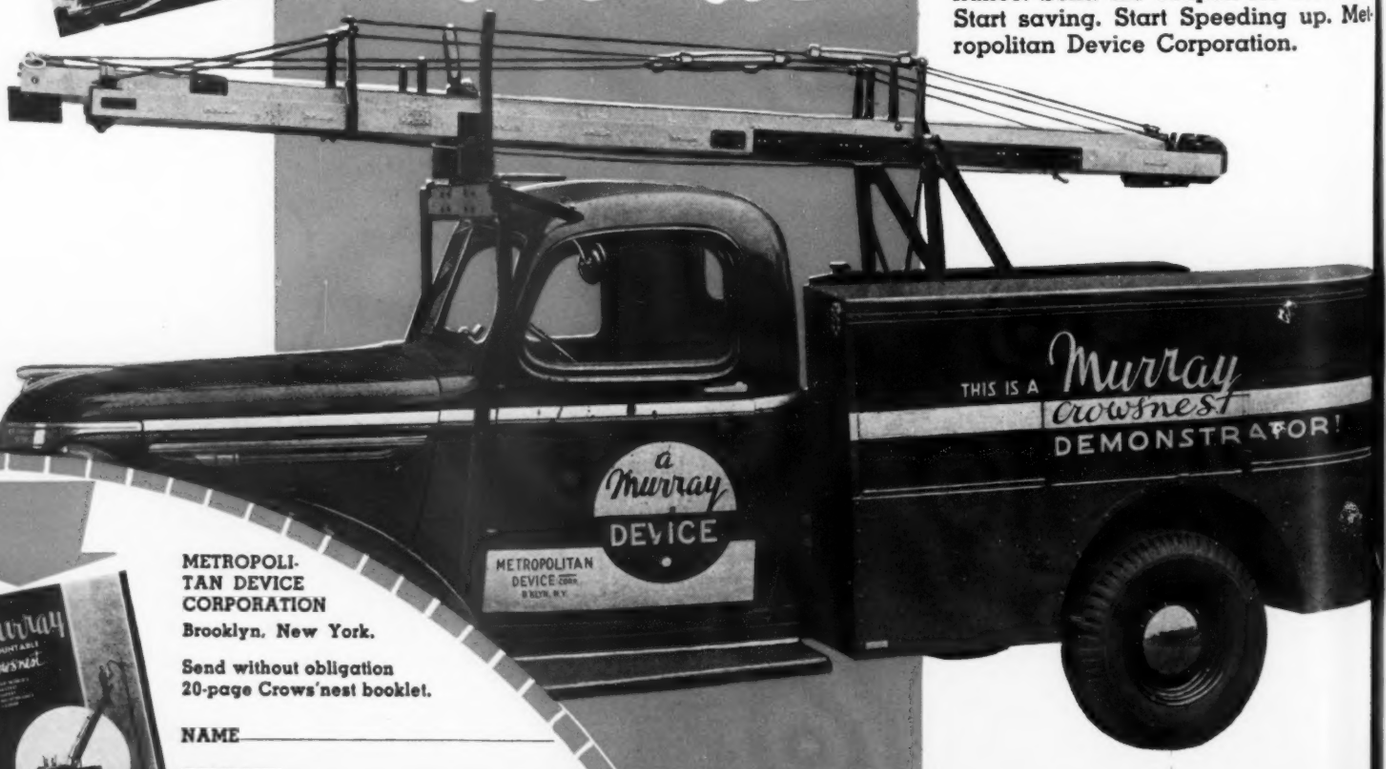

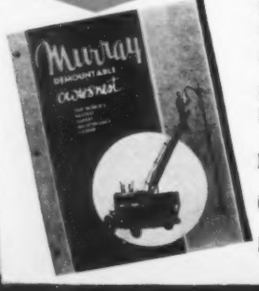

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November 1, 1941

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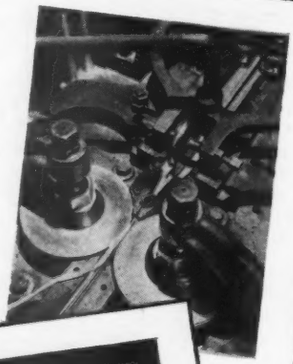

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Fighting Through

Two weeks ago a great cattle king died in Texas—a man who as a young tenderfoot from the East had dared to go out into that cattle range country with a few dollars to raise the detested "woolies." He went through a mental and physical hell, but when he died, in his eighties, he was in control of more land than the area of some of our states.

History is full of the names of people and races who, though outnumbered, outweighed, outarmed, refused to be defeated and finally won out. David and Goliath is perhaps the most publicized case.

Here in this country we have a continuous record since the first settler stepped foot on these shores of struggle against what seemed like insurmountable obstacles. The weak didn't survive, those who gave up easily were lost, but those who had courage and determination won out.

There are certain electric utility executives who appear to be made of different stuff than these pioneers of American business. They cannot see any hope, any future. To them the game has been played and the other side has won. They see only the ultimate capture of their properties by government and there is nothing to do but keep the old ship afloat until the prize crew comes aboard.

Suppose Drake had felt that way when the Spanish Armada came into view!

If there is one thing that characterizes the United States it is its affection for the under dog. How many people go to see Joe Louis win? Who was the hero of last November's election? Was it Mr. Roosevelt or was it the man without a machine, who, tired and throat sore, fought on against tremendous odds?

There are a growing number of Americans who are becoming alarmed at the growth of power in Washington. A few years ago these same people thought the utilities were too powerful and they backed public power and public regulation. Now they are beginning to swing back—at least those who know the facts.

The game is not up for those who have the faith to see and the courage to fight—honestly to fight, not just to create a nuisance value to get a better price on a sell-out. If business management of utilities is better than political management for any reason, then the public is entitled to know those reasons.

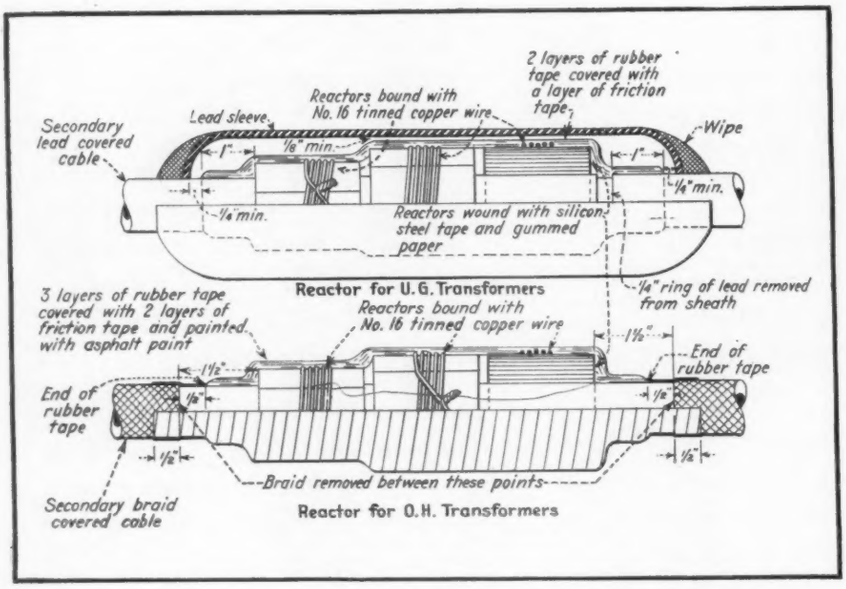
The United States has not yet gone the way of Italy and Germany. There are still 130,000,000 people here, the most of whom want to continue to live as free men and women. Let them decide what shall be the fate of the utilities—not a small number of misrepresentative men in Washington.

Not only is there an intimate story to be told locally but a unified one to be told nationally. However, if fear, indifference, desire to go it alone, or any selfish motive is allowed to sabotage every effort for unified action, then the worst fears of those who know they are licked will probably be realized.

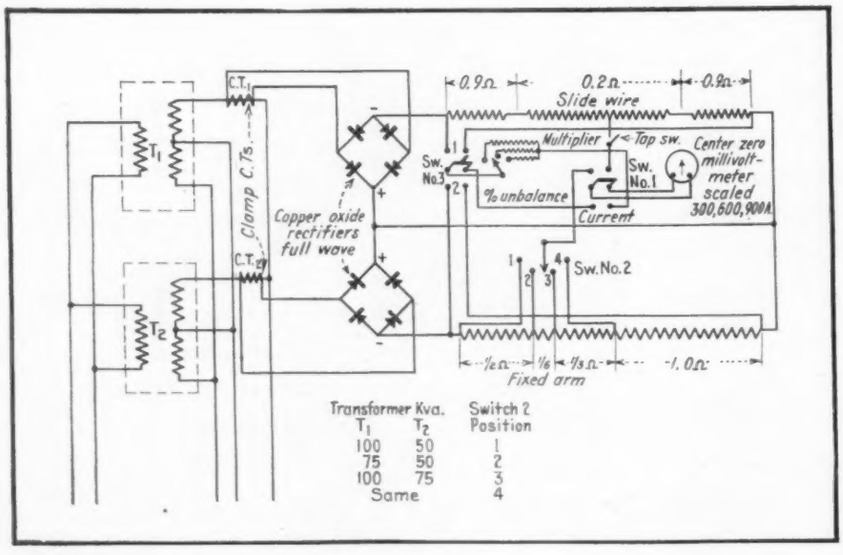
Balancing Parallel Transformers

Method utilizes a balancing set and field-wound reactors — Wide range of ratings exemplified — Poor connections brought to light

R. C. GHEN * **and C. F. AVILA,**† **Boston Edison Company**


2 layers of rubber tape covered with a layer of friction tape
Reactors bound with No. 16 tinned copper wire
Lead sleeve
Secondary lead covered cable
Wipe
1" min
1/8" min
1"
1/4" min.
Reactors wound with silicon steel tape and gummed paper
Reactor for U.G. Transformers
1/4" ring of lead removed from sheath
3 layers of rubber tape covered with 2 layers of friction tape and painted with asphalt paint
Reactors bound with No. 16 tinned copper wire
1 1/2"
End of rubber tape
1/8"
1/2"
Braid removed between these points
Secondary braid covered cable
Reactor for O.H. Transformers

DETAILS of installation for reactors for underground and overhead type transformers



WIRING DIAGRAM of transformer balancing set

WHEN OPERATING distribution transformers in parallel it is essential to obtain good load division. Identical transformers and field conditions being the exception, an exact balance is rarely possible without external reactors. By using field-wound type reactors and the transformer balancing set described below a good balance is easily obtained without disconnecting the secondary cables.

Loss in Reactors Low

The field-wound type reactor consists of a number of turns of silicon steel tape 2 in. wide x 0.015-in. thick with a gummed paper spacing tape, wound on the secondary cables of the transformer having the higher load. The paper tape assists in installing the steel and insulates the turns. The load division is checked with the transformer balancing set while the tape is being installed until a balance is obtained. If necessary, several coils of convenient diameter may be installed side by side on a single cable. On non-leaded cables the coils need to be protected merely with rubber-insulating compound, friction tape and asphalt paint. For leaded cables a ring of sheath must be removed adjacent to one of the coils to avoid inducing high sheath current. A lead sheath may then be installed to make a complete submersible unit. A unit is installed in each phase leg for either a single- or three-phase transformer. None is installed in the neutral.

* Test and research section, engineering department.
† Distribution technical division, transmission and distribution department.

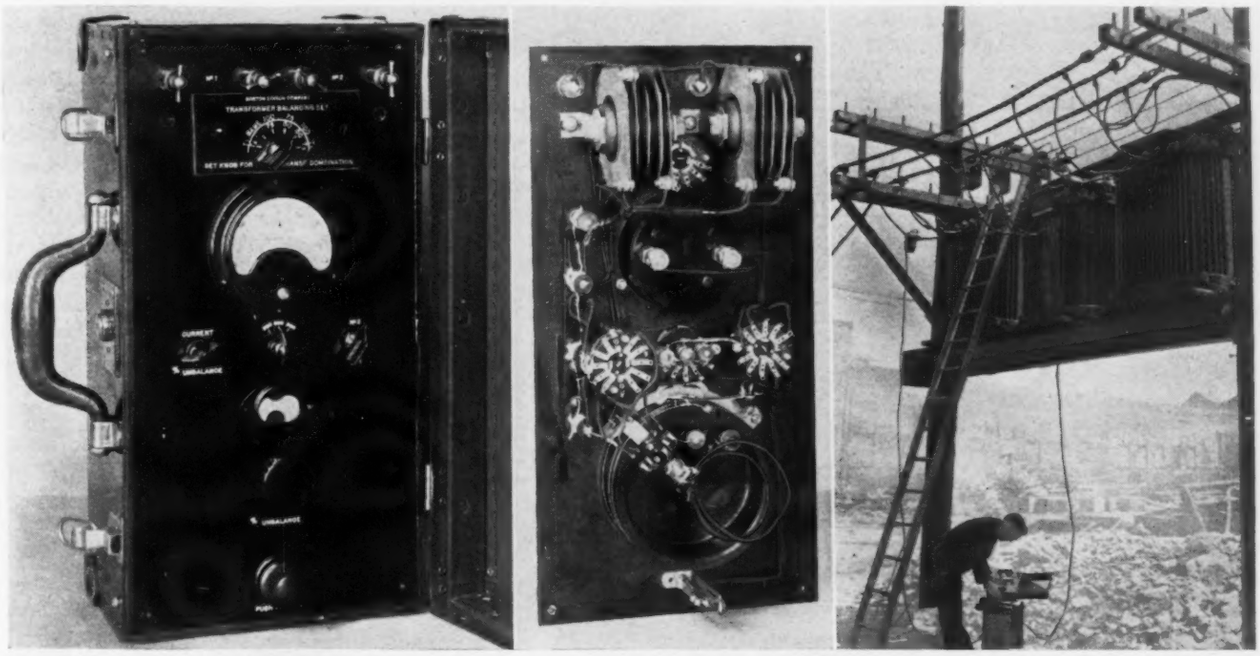
Because of the nature of the flux paths in a spiral winding of steel tape spaced with paper the area of the iron circuit is only the cross-section of the steel, while the area of the air gap is the average area of one complete turn of the paper spacer, which means that the paper gap adds very little reluctance. With 500 amp. flowing in the conductor the steel runs at about 80,000 lines per sq.in. The result is economy of volume and weight of material, but a variation of reactance with load, because of the shape of the magnetization curve of the steel. The transformers may be made to share load exactly at any point. At other loads a slight unbalance will exist, but this effect is not serious. Due to the small volume of steel necessary, the watts loss in the reactors is very low.

Due to the fact that the load is constantly changing, it is impossible to take simultaneous current measurements with two ordinary clamp transformer type instruments and obtain the necessary accuracy without taking a large number of readings—at best a somewhat lengthy and uncertain operation. With the transformer balancing set it is possible to measure the percent unbalance and add the reactors until a balance is obtained.

The equipment consists of two specially wound clamp transformers (1,000-turn secondaries), current transformers C.T.1 and C.T.2, each feeding a copper oxide rectifier. The output of the rectifier connected to C.T.1 is fed through a 2/10-ohm slide wire with two end resistors of 9/10 ohms, giving a total resistance of 2 ohms. The output of the other rectifier is fed through a 2.0-ohm fixed resistance with drop points brought out for 1.0, 1⅓, 1½ and 2.0 ohms. The positive terminals of the rectifiers are tied together and connected to the common point of the 2.0-ohm arms. By throwing a switch (No. 1) to the "percent unbalance" position the null indicator (a Weston model 643 d.c. millivoltmeter, center 0, 12.5–0-12.5 millivolts scaled to read a.c. amperes) is connected between the drop point on the slide wire and the proper point on the fixed arm with a tap switch in series.

With the drop points as shown, it is possible to balance a 100-kva. transformer with a 50-kva., 100 with a 75, 75 with a 50, 100 with a 100, 75 with a 75 and 50 with a 50. Switch No. 2 selects the proper drop point. The slide wire has two turns and is 5 in. in diameter, which gives an effective length of approximately 30 inches. The scale reads up to 10 percent unbalance either side of 0 and indicates which transformer is delivering the higher current. Two transformers of equal rating share load properly when their output currents are equal in magnitude, but not necessarily in phase relationship. Hence, there will usually be a vector difference between the output currents. The copper oxide rectifiers act as phase displacement eliminators, enabling direct comparison of the vector magnitude.

By throwing switch No. 1 to the "current" position it is possible to measure the current being delivered by either transformer, depending on the position of switch No. 3. In this case the null indicator is used as a millivoltmeter measuring the drop across either arm. This instrument is center-zero scaled to read directly in a.c. amperes with three scales, viz., 300, 600 and 900. If the percent unbalance is greater than the range of the slide wire, it is possible to take readings of the current in each transformer and reduce the higher current, as explained above, until the percent unbalance is within range of the slide wire.



PANEL ARRANGEMENT (left) and interior arrangement (center) of balancing set. At right apparatus being used in field to balance load on three 100-kva. transformers installed on pole platform

Reactor Winding Procedure

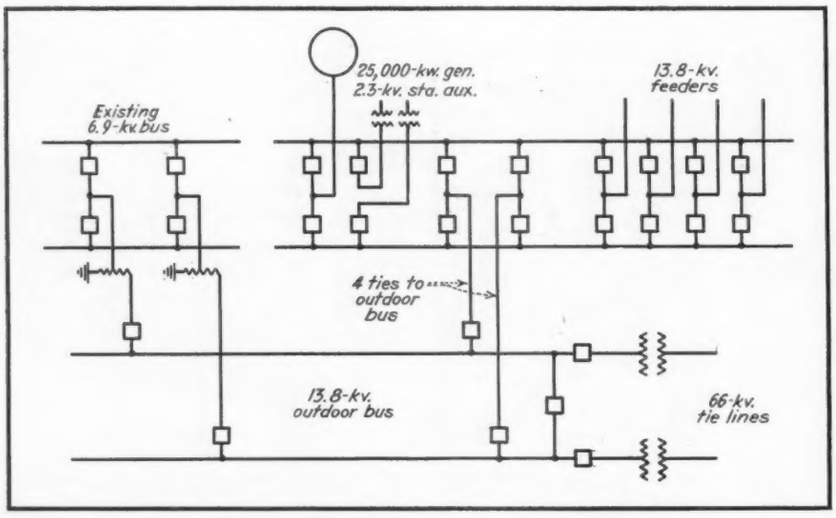
In practice the clamp transformers are installed on corresponding phases of the transformers to be balanced. After determining which transformer is taking the greater share of the load the reactor winding is started. As each coil is completed a similar coil is

[*Continued on page 116*]

Air-Blast Cubicles Give Space Economy

Steel Point installation affords more breaker positions in available space than equivalent oil breakers — Phases isolated — Comprehensive interlocking

*R. S. VAN HORN * and C. A. MOLSBERRY,† United Illuminating Company, Bridgeport, Conn.*

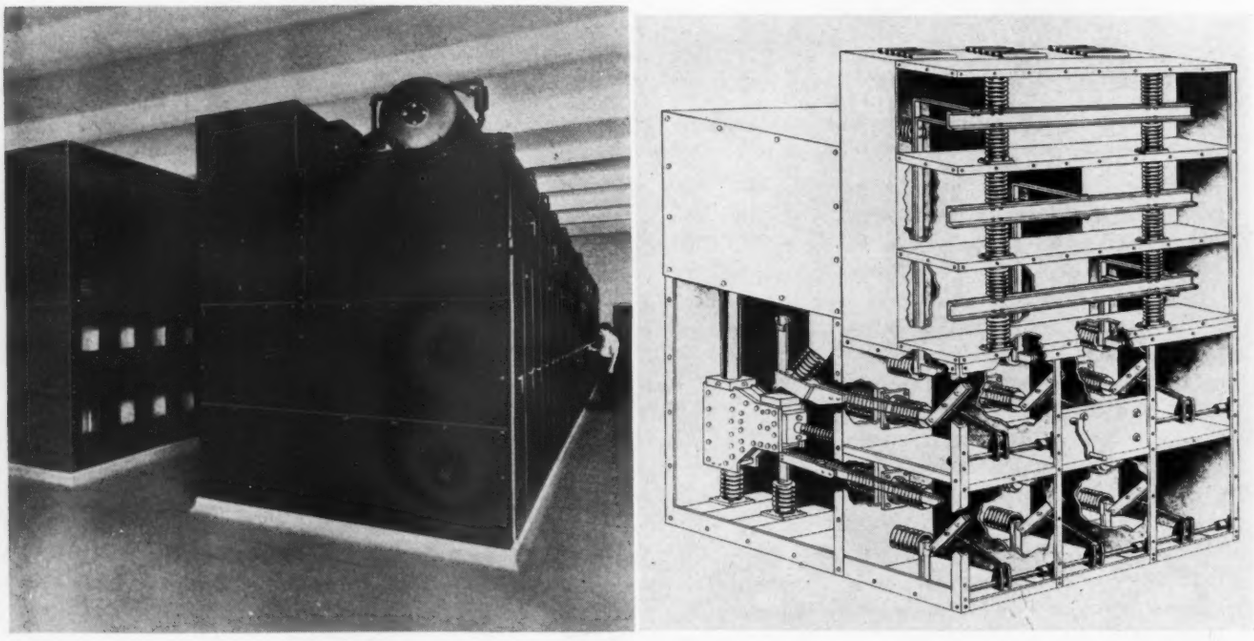


ADDED CUBICLES afford four distribution feeders and two bus ties

SPACE CONSIDERATIONS were the determining factor in the choice of air-blast circuit breaker cubicles for the 13.8-kv. generator and feeder positions of the main switchgear for the addition of a 25,000-kw. turbo-generator at the Steel Point (Bridgeport) station of the United Illuminating Company.

Reduction of fire hazard was an attractive feature and so were the compactness, interlocking and phase segregation obtainable in modern cubicle construction. But the possibility of getting four air-blast units into an existing 18-ft. bay against only three of the oil-breaker forms determined the choice of design. It

*Vice-president. †Electrical engineer.



TWO ROWS of 13.8-kv. air-blast cubicles made efficient use of available space (left). Each three-phase unit comprises phase bus segregation, isolating disconnects, air-blast breakers and interlocking (right).

meant that ten cubicles of 13.8-kv. air breakers could be put into the existing space as against seven oil breakers, because the steel housed three-phase air-breaker cubicles are each only 4½ ft. wide. Furthermore, the width of 4½ ft. made possible at some future date the removal of any of the existing oil circuit breakers on the 6.9-kw. bus, replace them with air-blast breakers and retain existing concrete cells for reactors and feeder raceways.

Previous generator units in the plant are 6.9 kv. These now feed into the 13.8-kv. outdoor bus through 2/1 auto-transformers. The new generator unit was chosen to be 13.8 kv. as further units at 6.9 kv. would have required additional breaker capacity because of the higher current ratings involved. The new gang of 13.8-kv. cubicles is in line with the previous 6.9-kv. cells, but separated from them at present by a wall. The 66-kv. tie lines shown are those discussed in ELECTRICAL WORLD April 19, 1941 (page 44), and July 26, 1941 (page 34).

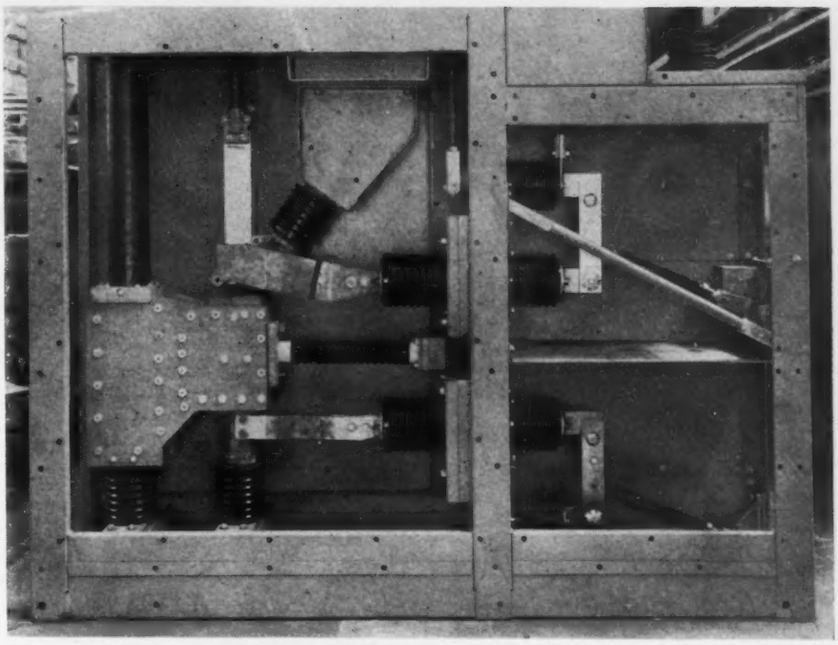
Double Bus

The installation consists of two rows of ten General Electric air-blast breaker cubicles. Two generator breaker cubicles are rated at 2,000 amp. and the remaining eighteen at 1,200 amp. Bus differential protection is provided. The interrupting rating is 1,000,000 kva.

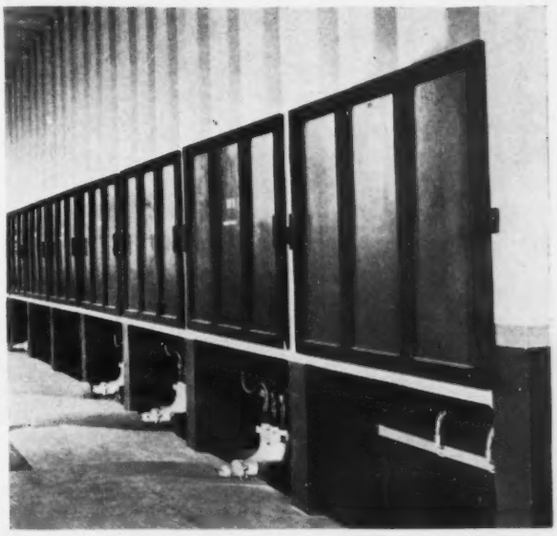
Grounded steel partitions isolate each phase and there are two group-operated, heavy-duty disconnecting switches per phase to isolate the breaker elements for maintenance. The channel buses are rigidly supported by a linear arrangement of insulators. Mechanical interlocks are incorporated and the details are shown in an accompanying illustration. Relay bushing current transformers are incorporated in the cubicles to avoid the necessity for their separate installation elsewhere in the bus run.

The air-compressor installation is on the floor above. The cubicles are placed to line up with the raceways for the bus runs to the feeders on the floor below.

In conjunction with the prospective addition of generating capacity it is planned to replace two rows of 6.9-kv. breakers in concrete cells with two rows of eighteen air-blast cubicles and utilize existing cells for reactors and conductor raceways.

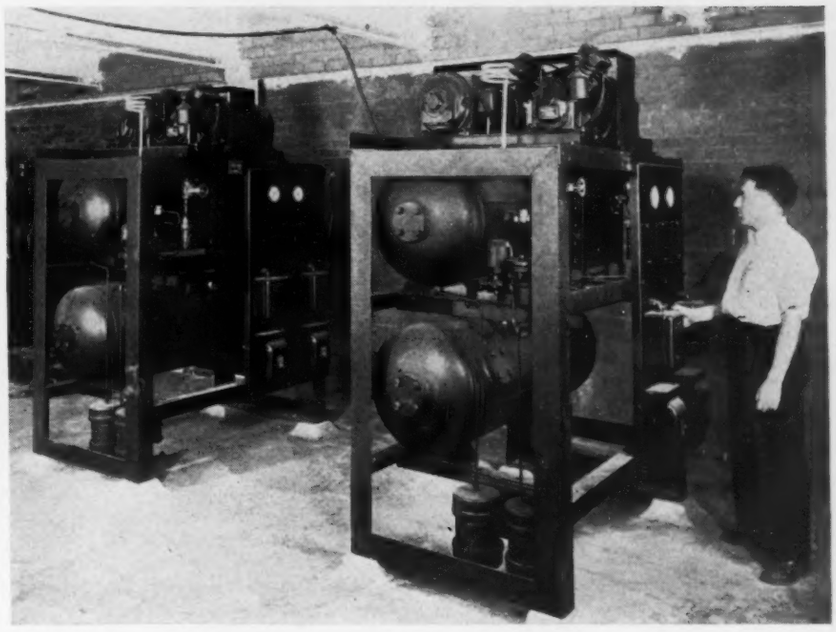


INTERLOCKING ROD prevents opening disconnect until breaker is opened. Also necessary to close disconnect ahead of breaker and doors locked when disconnects are operated. Disconnect operating handle cannot be inserted at right until breaker is in open position.



INTERPHASE barriers for bus runs to feeders are directly below the breaker cubicles

AIR compressor units are on floor above



Fluorescent Popular in Pennsylvania

Report to Electric Association shows commercial customers favor fluorescent — Intensities doubled and special studies show little change in kw., kw.-hr. due to fluorescent

THE POPULARITY of fluorescent lighting in commercial installations and the need for engineered sales are stressed by seven utility companies serving the greater portion of the state of Pennsylvania, which recently summarized their experiences with fluorescent lighting in the commercial field in a report to the commercial sales committee of the Pennsylvania Electric Association.

H. E. LeVan, chairman of the commercial sales committee of PEA and director retail sales, suburban divisions of Philadelphia Electric Co., advised that all of the reporting companies conform in their sales and promotion policies with fluorescent lighting principles established by the Edison Electric Institute.

Seven Conclusions

The conclusions reached by the survey are:

1. Commercial customers like fluorescent lighting and there is every reason to believe that they will buy more of it.

2. While 25 percent of the customers interviewed have purchased fluorescent because they thought it would reduce the cost of electricity, 75 percent purchased it for other reasons. There is every indication that the desire for better lighting and the desire to be modern will continue to be the dominant buying motives in the sale of fluorescent lighting.

3. Practically all types of commercial customers are prospects for fluorescent lighting.

4. As a general rule, it can be stated that intensities have doubled where fluorescent lighting has been installed, but with 74 percent of the jobs going in below 30 ft.-candles there is a very considerable need for utility promotion to raise this level further.

5. While there is no assurance that an accurate cross-section has been secured, the results today indicate that in the aggregate the kilowatt-hours are practically unchanged where fluorescent has been installed.

6. There is every reason to believe that the total connected load will show a decrease if all fluorescent lighting jobs are considered. However, when 801 jobs indicate a net increase of 2 kw., there is no reason to believe that the change will be very serious. It also seems reasonable to conclude that the major decreases have resulted where fluorescent has replaced incandescent in windows. Since very few of the fluorescent window lighting jobs have been satisfactory, there are definite reasons why the utility salesmen should be able to protect the window-lighting load.

7. It has been recognized for some time that special consideration must be given to the salesmen's reports on fluorescent lighting. The salesmen usually feel that they are entitled to credit for more load than the actual connected load figures would indicate. If we are to have an effective sales force, this fact must be recognized.

The questions and answers from which the conclusions were derived are as follows:

Question 1—Do commercial customers like the fluorescent equipment they have purchased?

Answer 1—85 percent of the customers interviewed gave an unqualified "Yes" to this question.
13 percent said "Yes, with reservations."
2 percent said "No."

Question 2—What reasons do commercial customers give for buying fluorescent lighting equipment?

Answer 2—They gave three main reasons:
47 percent said better lighting.
25 percent said to reduce the cost of electricity.
20 percent said they bought the equipment to be modern.
The other 8 percent gave miscellaneous answers to this question.

Question 3—What types of commercial establishments are buying fluorescent equipment?

Answer 3—The 116 customers covered by the survey included 32 different types of establishments using fluorescent equipment, so the conclusion is that it is not limited to any particular field.

Question 4—What foot-candles are being installed?

Answer 4—The following tabulation gives the foot-candle range:

Below 20 ft.-candles	34 percent
20 to 30 ft.-candles	40 percent
30 to 40 ft.-candles	12 percent
40 to 50 ft.-candles	11 percent
Above 50 ft.-candles	3 percent

Improvement Noted

While this indicates that 74 percent of the jobs are under 30 ft.-candles, we are satisfied that this is a considerable improvement over former conditions.

Question 5—What has happened to the kilowatt-hour sales where customers have installed fluorescent to replace incandescent lighting?

Answer 5—On 116 jobs the average monthly kilowatt-hours used *before* was found to be 235,559, and the use *after* was 237,944—a difference of 2,385, which is a 1 percent increase. These figures represent a sample for the entire state. One of the companies reported on 41 jobs. These jobs showed a decrease in connected load of 22 kw. but the average monthly kilowatt-hour use before and after varied less than 1 percent. This would seem to indicate longer burning hours.

Question 6—What is happening to the connected load when fluorescent lighting is installed?

Answer 6—No company keeps a record of all fluorescent jobs. One company studied 801 jobs where incandescent lighting was replaced by fluorescent. These jobs were reported by the salesman and do not necessarily represent a cross-section of the total picture. The report shows that on approximately one-third of the

[*Continued on page 121*]

Distribution Neutral Used for Series Circuit Return

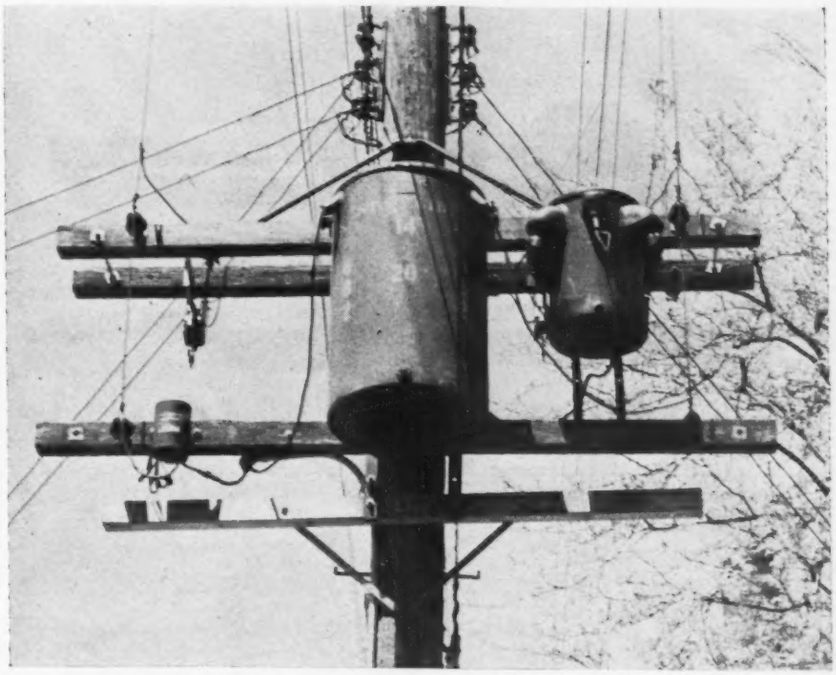
Multi-grounded primary neutral performs several functions — Disconnect switches ground series circuit for trouble, patrol, tests and maintenance

T. M. REED, Ohio Public Service Company, Lorain*

OVERHEAD electrical distribution system in Lorain is a 2,400/4,160-volt, four-wire, multi-grounded network, using the overhead neutral or ground wire for various purposes; *i.e.*, primary and secondary neutral current, distribution transformer case grounds, lightning arrester interconnections and return street-lighting current for constant current transformers and insulating transformers.

Use of the overhead neutral wire as a part of the series street-lighting circuit greatly reduces the amount of wire and other construction costs necessary when building a new system. This is especially true with long streets of high-intensity lamps, closely spaced, where one wire can be installed the full length of the street and grounded on each end.

On both the new single-wire circuits and the older type looped circuits with one point permanently grounded the constant-current transformers are located so that the load on each leg between the transformer and the grounds is approximately one-half of the circuit capacity. A porcelain-housed, solid-blade disconnecting switch is installed on each leg of the secondary side of the constant-current transformer with the blade side of the switch connected to the overhead neutral wire and also the lightning arrester ground. The permanent ground at the approximate mid-point of the load not only limits the potential of the series circuit above ground to one-half of the operating voltage of the constant-current transformer but also greatly facilitates trouble shooting.



SINGLE-POLE mounting of street light transformer controller on right. Novalux protector at left on kicker arm. Grounding switches back of double arms

Locating Trouble

In event of trouble with a series circuit the patrolman immediately goes to the transformer station, and if inspection shows everything to be satisfactory he will close one of the grounding switches. If the street lights on the opposite side of the circuit come on the patrolman knows that the trouble is on the grounded side. If the lights do not come on he opens the first ground switch and closes the other and then starts his patrol of the side in trouble. This not only has the advantage of limiting the patrol to only one-half of the circuit but it allows service to be maintained to one-half of the circuit while the other side is being patrolled.

One of these ground switches may be carried on the truck, and in event that the open circuit is not readily located by patrolling it may be used as a portable outfit to put grounds

*Engineering assistant.

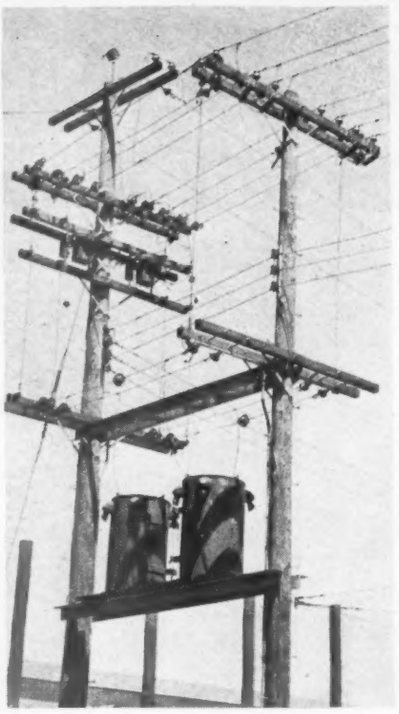
on the circuit wherever desired in order to test. Our experience in this territory has been that should no overhead neutral wire be available at the desired point a short length of ground rod can be pushed into the ground by hand and will serve very satisfactorily as a temporary ground.

In order further to minimize the amount of time spent in patrolling the series street-lighting circuit these grounding switches can be installed at the quarter points of the circuit if so desired.

Maintenance Advantages

Our company operating code requires that all series street-lighting circuits must be grounded at the transformer when they are worked as a dead line, such as when washing of glassware and painting of fixtures. The grounding switches are more convenient and have many advantages over the old practice of installing temporary ground jumpers.

Another advantage of having permanent grounds on series street-lighting circuits is that they can be used to balance the load between two adjacent circuits. For example, two constant-current transformers are mounted on a platform and one transformer is somewhat overloaded and the other is underloaded, resulting in poor current regulation on both circuits. The secondaries of the two transformers can be connected in series, regardless of the feeder phase connection on the primary side and the location of two permanent grounds can be so shifted that the load between the two transformers will be equaled.

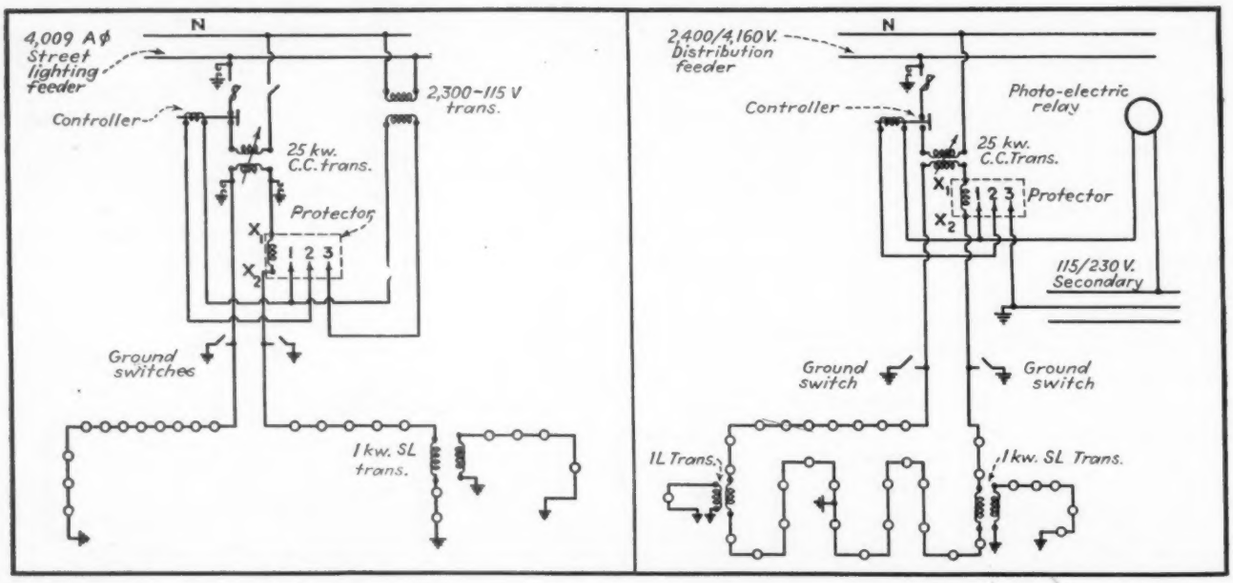


TYPICAL constant current transformer station provides two 25-kw. units. The photo-electric relay target is visible at the top of the pole at the left

All constant-current transformers in our territory are either directly controlled by photo-electric relays or energized from a 2,400/4,160-volt street-lighting feeder, which is also controlled by a photo-electric relay in the substation.

Each constant-current transformer is also equipped with a Novalux protector, which, operating the controller, disconnects the transformer from the 2,400-volt primary in event of an open circuit. This protector eliminates the hazard to the public of having high voltage on fallen series circuit wires and also allows insulating the system for the operating voltage of the constant-current transformer rather than the open-circuit voltage.

The combination of the permanent grounds and the protector allows the use of lower voltage insulators, underground cable, pole and fixture wiring and also eliminates the need for insulating transformers in some cases. In order further to reduce the operating voltage on circuits which have 10,000-lumen lamps or larger a 20-amp. straight series system can be used. There are two 20-amp. straight series circuits with 10,000-lumen lamps on ornamental standards fed by 25-kw. constant-current transformers in use in Lorain, where this combination has permitted the use of 600-volt "Versatol" wire in the fixtures.



SINGLE-WIRE street-lighting circuit served from special street-lighting feeder is grounded at the extremities

LOOPED street-lighting circuit served from distribution feeder phase and controlled by photo-electric relay

Left—Disconnect grounding switches provided on each side of the open loop. Right—The disconnecting ground switch is of the type which allows the door to be closed when the switch blade is either open or closed. The open blade is visible from street level and indicates that the circuit is not at that point grounded to the primary neutral.

System Protection Analysis Precedes Oswego Design

Months devoted to study of system faults and possible conditions of instability — Also, study of operation and relaying for alternative schemes using existing lines to connect new steam station to the Niagara Hudson System

GEORGE STEEB, Buffalo, Niagara & Eastern Power Corporation*

ADDITION of new generating capacity to an interconnected transmission system having several sources of power involves an intensive study to assure most reliable operation of the expanded system. Analysis of the fault and instability possibilities in connection with the decision to add steam capacity began before the actual location of the station was definitely decided. In parallel with the consideration of the economic factors influencing the location of the station there had to be a great many system impedance and fault current determinations by calculation and by means of the d.c. calculating board to make sure that the existing breakers and lines in service would function satisfactorily under any likely set-up of lines which would be in service under normal conditions and which might exist under emergency conditions.

It is not generally appreciated that each single set-up of line fault conditions requires several days merely to ascertain what three-phase fault currents will occur at each of the many relayed points. Without such determinations, however, the engineers cannot be reasonably sure that faults can be cleared, stability maintained and economical operation of the system be assured.

Five Alternatives Explored

Five alternative ways of rearranging existing lines and tying the new Oswego station into the system were studied to determine the best arrangement of circuits to give maximum reliability of service and at the same time keep, as far as possible, both multiphase and phase-to-ground faults within the interrupting capacity of the existing circuit breakers on the Central New York system, into which the station feeds.

Meanwhile, studies were being made to determine the proper design of the station itself, so as to provide an additional economical and reliable source of power connected to the system in such a manner that it would remain connected even under extreme emergency operating conditions.

Since the new station at Oswego is designed as a system generating plant and has no low-voltage primary distribution, its two 80,000-kw. units can each be connected directly through two 50,000-kva. banks of transformers without low-tension bus or breakers to the high-tension bus. The station service supply is taken from two 7,500-kva. wye-delta banks of transformers, each tapped off the leads of its respective generator. There is an alternative house service supply through a third 7,500-kva. bank of transformers connected to the 33-kv. system which supplies the Oswego area and is interconnected with the Syracuse 33-kv. system (see Fig. 1).

One of the first decisions to be

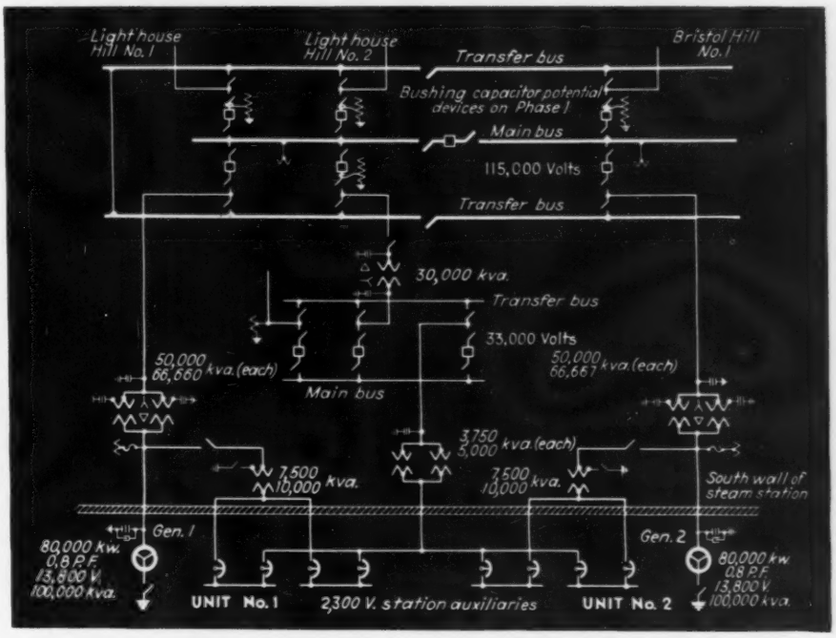


FIG. 1—One-line diagram of the electrical connections of Oswego steam station

* Relay engineer.

made was whether to ground the neutral of the generator (1) solidly, (2) through a reactor, (3) through a 5-ohm resistor, (4) or not at all. Solid grounding was found to be undesirable because the possible 62,000-amp. fault in the generator neutral, shown by the studies, would place unwarranted stresses on the windings of the equipment and the station bus. A 5-ohm generator neutral resistor would reduce the generator neutral fault current to some 1,400 amp., but the neutral current could be kept to 9,720 amp. by providing the station neutral ground at the neutral of the wye-delta service bank and using this bank as a neutral reactor.

With one-cycle relaying and high-speed breakers, a fault of 9,720 amp. would be cleared in sufficient time to prevent injury to the generator, and this method of grounding was adopted. A grounded neutral on the station service bank would also eliminate the need for a ground-detecting device and the complications that are part of such a device, which would have been necessary with an ungrounded system.

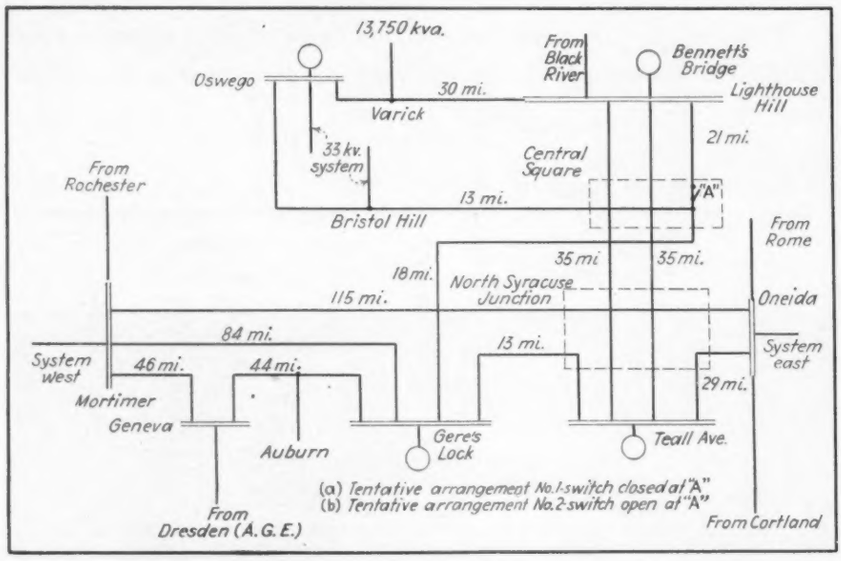


FIG. 2—Early tentative arrangements of system

(a) Tentative arrangement No. 1—switch closed at "A." Generator neutral grounding found less desirable than grounding neutral of wye-delta station service bank. It tentatively warranted distance relay application at the station; however, the four branches from the junction point "A" precluded the positive functioning of distance relaying under various probable operating conditions.

(b) Tentative arrangement No. 2—switch open at "A." Involved leaving open line from Lighthouse Hill to Central Square to break up four-way arrangement which made arrangement No. 1 impracticable. Nevertheless, the short line from Gere's Lock to Teall Avenue tended to fix the distance relay setting at Oswego at values not appropriate for faults on other lines from the same source.

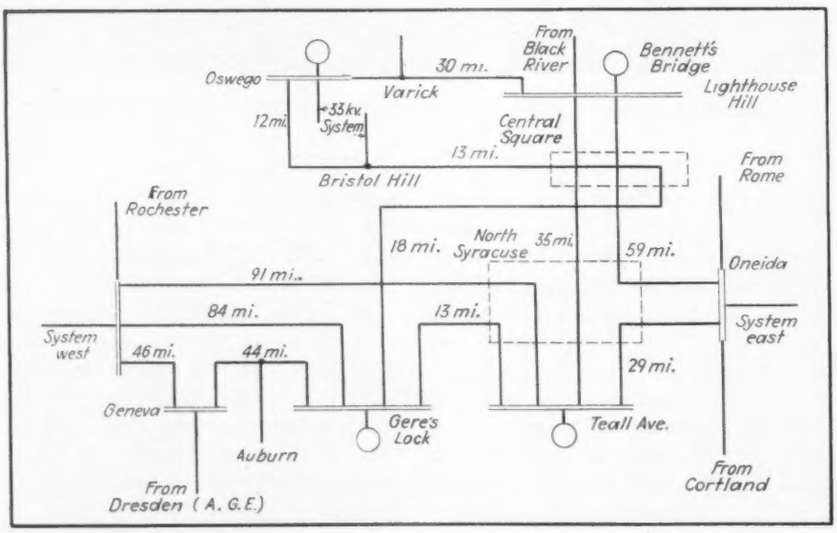


FIG. 3—Tentative arrangement No. 3

This arrangement lowered the impedance between Oswego and the system to the east with gain in stability under fault conditions. But it still left considerable inequalities between fault possibilities and, therefore, did not promise ease of relay setting if the preferred distance relaying were adopted.

First Tentative Arrangement

Study of the system arrangement (shown as Tentative Arrangement No. 1 in Fig. 2) gave indications of the degree of adequacy of breakers on the system. It also showed that the 13,750-kv. hydro plant at Varick, which taps the 115-kv. system, would not interfere with the application of distance relays between Oswego and Lighthouse Hill, and there would be no appreciable voltage changes at Oswego which would interfere with functioning of distance relaying.

It was found that the four points of connection on the line between Gere's Lock, Lighthouse Hill, Bristol Hill and Oswego precluded the use of distance relaying, due to the fact that considerable current may be taken from or supplied to the line at the intermediate points, resulting in inaccurate distance relay measurements. Carrier relaying was therefore tentatively indicated, but this was impracticable because it would limit the flexibility of switching arrangements with transfer buses at two of the points. Tentative Arrangement No. 1 was discarded, but it had meanwhile developed enough information to guide the station layout and equipment characteristics which would apply regardless of the ultimate external arrangement.

Second Tentative Arrangement

Certain junction points (Central Square and North Syracuse) afforded the oportunity to reconnect lines (at moderate expense) for normal operation, making it possible to simplify the relaying and limit the fault currents by taking best advantage of point to point impedances. The arrangement shown as Tentative Arrangement No. 2 in Fig. 2 was founded on normal operation with the 21-mile line from Lighthouse Hill to Central Square open at point "A." This made possible better relaying and load studies show that the carrying capacity of this connection would

not be required when the steam station connections were made.

Insulators and cable from this section of line were later reused at other points. Fault currents and bus voltage values were studied in detail and it was found that faults were approximately the same for this proposed normal connection as they were for Tentative Arrangement No. 1. The fault current studies indicated that with the single intermediate connection at Bristol Hill distance relays could be properly used between Oswego and either Lighthouse Hill or Gere's Lock, depending on the position of the switches at point "A."

A supplementary study at this point in the series of studies showed that it would be feasible to make the breaker on the 115/33-kv. bank at Oswego serve also as a 115-kv. transfer bus breaker, and thereby save the expense of an additional 115-kv. breaker and one section of bus structure. It was found that only one set of distance and ground relays would be required for this breaker, as the impedance is nearly the same regardless of which of its four possible functions the breaker may be serving.

When this breaker is used in place of the generator breaker the relays may be somewhat sensitive to system swings, but as this condition exists only a few hours per year it is felt that this limitation is not serious. This same study led to the use of high-speed power-directional relaying as the generator breaker instead of differential protection because of the transfer bus scheme (shown in Fig. 1). The relay installed has inverse time characteristic with instantaneous attachments directionally controlled and the combination is not critical during system oscillation.

One serious disadvantage of Arrangement No. 2 was found to be the short length of the Gere's Lock-Teall Avenue line, which virtually fixed the relay setting at Oswego at a value for faults on the much longer lines connected through to other points. Also, operation with the long 115-mile line from Mortimer to Oneida out of service for maintenance introduced undesirable obstacles and Arrangement No. 2 was therefore given up.

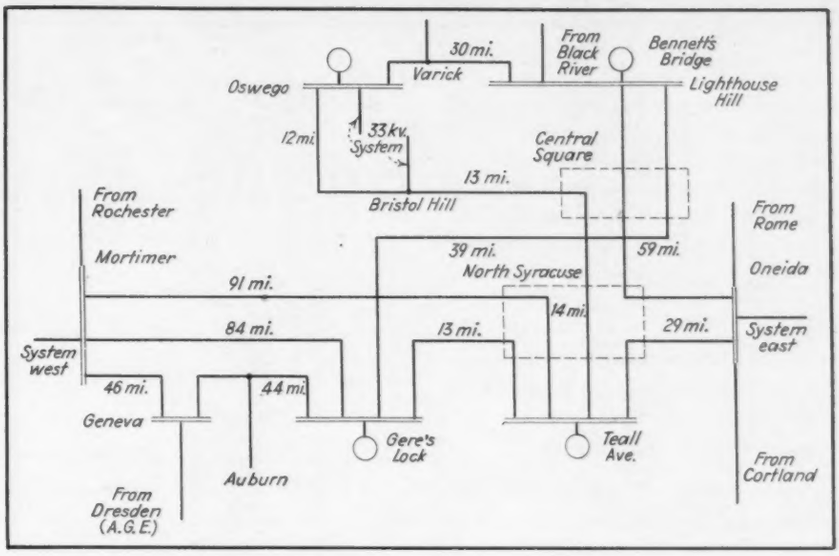


FIG. 4—Tentative arrangement No. 4

This arrangement gave improved impedance equality and was almost equal to arrangement No. 5, which was the adopted one. However, it had the defect of presenting too high an impedance from the west to the east systems for confidence in stable operation under fault conditions.

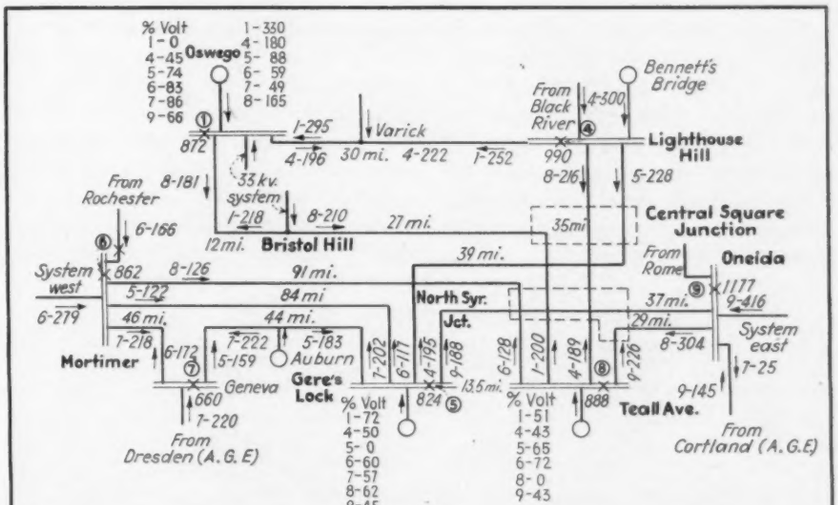


FIG. 5—Tentative arrangement No. 5, which is also the system of connections adopted

This arrangement gave the best impedance equality without detriment to the Syracuse network voltages under system faults and generally gave better operating stability and relaying than the four preceding arrangements.

Nine fault positions are shown by X's, at each of which an encircled numeral identifies the position and a figure gives the total M.V.A. that would flow into the fault. The left hand tabulation at Oswego shows the voltage in percent of normal that would exist at Oswego with a solid three-phase short applied at the fault position indicated by the figure before the dash. A similar table is shown for Gere's Lock and for Teall Avenue. The table at the right of Oswego shows the M.V.A. that the Oswego generator would supply to faults at the different locations indicated. The figures along the 115-kv. transmission lines show only the M.V.A. for the faults giving the maximum values.

The study drawing contains two tables for each fault position similar to the tables shown for Oswego.

Third Tentative Arrangement

Study of the system arrangement shown in Fig. 3 was to try to get better impedance coordination between the sections of the long Mortimer-Oneida line with the alternative routes between the Oswego-Gere's Lock line and the lines between Mortimer and Oneida. All fault values were redetermined for the new set-up. It was soon seen that dividing the Mortimer-Oneida section at Teall Avenue did lower the impedance between Oswego and the system to the east of Oneida and this gave assurance of stability in that direction. Voltages were found to be such that satisfactory operation of the distance relays could be

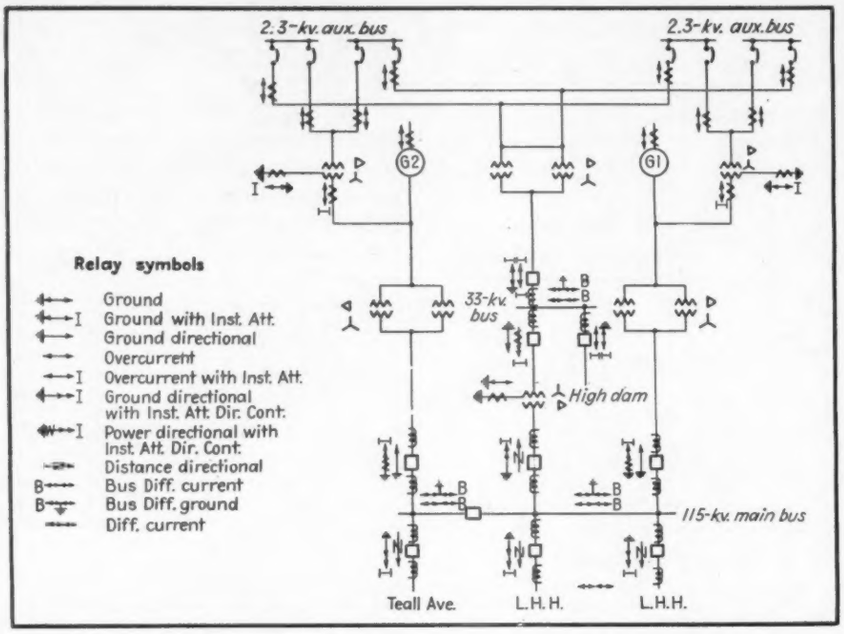


FIG. 6—Symbolic representation of the relay application at the Oswego steam plant

expected. While this arrangement seemed to be better than Arrangements No. 1 or No. 2, it still was not all that was desired from the circuit-operating and distance-relay standpoints. A thorough study of fault currents indicated that existing breaker interrupting capacities would be satisfactory.

Fourth Tentative Arrangement

The study of the system arrangement shown in Fig. 4 involved reconnecting the available lines so as to tie Oswego plant into Teall Avenue and also tie Lighthouse Hill into Gere's Lock by means of simple changes at the Central Square junction. Again one objective was to obtain minimum impedance between Oswego and the system to the east. At first the fault current and bus voltage studies on the d.c. calculating board seemed to show this arrangement was better than the preceding set-ups and they were quite comparable for normal line operations. But with the Teall-Oneida line out of service the impedance from west to east proved a detriment to stability for arrangement No. 4.

Final Arrangement Adopted

Attention was next focused on the available connections at 33 kv. and 12 kv. from Teall Avenue and Gere's Lock into the Syracuse city system. The objective was to justify, if possible, the elimination of the short line between Teall Avenue and Gere's Lock on the 115-kv. system. If this could be done without injury to Syracuse operations it would still further help in equalizing the point to point impedance and, in particular, assure satisfactory operation of the distance relays desired for Oswego plant protection.

Analysis showed the elimination of this short (13.0-mile) 115-kv. line between Gere's Lock and Teall Avenue actually bettered the voltages on the Syracuse buses under fault conditions. It also improved the three-phase fault values generally over the high-tension system. This led to arrangement No. 5, shown in Fig. 5. This arrangement omits the short Gere's Lock to Teall Avenue connection and rearranges the ties between Lighthouse Hill, Gere's Lock, Teall Avenue and Oneida at the Central Square and North Syracuse junction. As typifying some of the comparisons that have to be made to determine the superiority of one arrangement of system connections over another, the accompanying table is included, which shows the point-to-point percent impedance to a 100,000-kva. base for arrangements 4 and 5. It will be seen that the range of impedance values for arrangement No. 5 is considerably less than for arrangement No. 4. This facilitates the positive functioning of distance relaying for general point-to-point application.

A final question to decide was whether or not to ground the 115-kv. system at the Oswego plant. Due to the unit design of the station, consideration had to be given to the ground fault currents with one or two units in

[*Continued on page 115*]

Point-to-Point Percent Impedances to a 100,000-Kva. Base for Arrangements No. 4 and No. 5

	Mortimer to Oneida		Mortimer to Lthse Hill		Mortimer to Oswego		Oneida to Lthse Hill		Oneida to Oswego		Oswego to Lthse Hill		Geneva to Oneida		Geneva to Teall Ave.	
	No. 4	No. 5	No. 4	No. 5	No. 4	No. 5	No. 4	No. 5	No. 4	No. 5	No. 4	No. 5	No. 4	No. 5	No. 4	No. 5
All lines in service	26.8	23.9	27.6	25.5	32.1	33.3	12.5	13.0	20.1	20.7	13.8	13.2	23.2	21.6	6.1	16.2
Lines Out																
Mortimer-Gere's Lock	33.8	31.2	33.4	33.1	39.4	40.0	12.5	13.0	20.0	20.7	13.8	13.3	24.2	22.2	6.2	20.7
Mortimer-Geneva	38.2	34.5	37.8	35.0	41.6	41.8	12.5	13.1	20.0	20.8	13.8	13.3	28.1	27.6	6.1	16.6
Mortimer-Teall Ave	35.2	34.7	35.4	37.9	41.1	48.5	12.5	13.1	20.0	21.0	13.8	13.4	25.0	24.8	6.5	19.6
Geneva-Gere's Lock	28.8	26.4	31.0	29.2	35.4	36.0	12.6	13.1	20.0	20 8	13.8	13.3	36.8	35.4	6.3	17.3
Assoc. Gas and Elec	31.2	27.3	29.4	26.9	33.3	35.0	13.0	13.4	20.6	20.9	13.8	13.3	32.4	29.2	6.2	16.6
Gere's Lock-Light. Hill	29.0	25.0	37.0	35.2	35.4	40.0	14.9	17.3	20.0	22.8	15.2	13.6	25.3	23.2	6.8	24.6
Oswego-Lighthouse Hill	26.9	23.9	30.5	26.6	44.4	49.5	13.8	14.0	36.8	36 2	42.2	37.9	27.6	21.6	6.3	17.3
Oswego-Teall Ave	27.0	23.9	30.5	26.6	51.2	48.8	13.9	14.0	33.6	34.0	20.0	20.2	23.4	21.6	6.3	17.3
Teall Ave.-Oneida	38.5	28.8	29.4	25.8	32.3	35.0	16.7	19.4	29.4	31.4	14.7	13.8	32.9	23.9	6.5	23.7
Gere's Lock-Teall Ave	29.2	31.2	27.8	26.3	34.7	35.2	13.2	16.1	20.0	22.7	14.7	13.3	27.6	29.4	26.4	22.8
Lighthouse Hill-Oneida	27.8	24.0	29.0	29.0	32.2	33.5	18.3	15.7	23.2	20.8	14.0	15.1	24.5	21.6	6.2	19.4
Assoc. & Teall-Oneida	52.4	33.1	33.6	26.6	34.0	35.5	17.8	18.8	32.5	31.4	15.1	13.9	52.6	33.1	6 5	23.3

Broadened Approach to Residential Lighting

To fill gap caused by appliance shortage Washington Water Power develops plan to supply increased revenue and improved sales morale

THE PROSPECT of a shortage of durable goods, especially in major electric appliances, throughout the industry has forced the Washington Water Power Company's sales department to develop a broader technique in its approach to the time-worn service of residential lighting. What the diagnostician is to the sick-room, what a landscape gardener is to home owners, so the salesman now becomes qualified to both diagnose numerous troubles found in lamps or lighting, room arrangement, color harmony, and to prescribe effectively remedies in language understandable to the customer.

The plan, tailored to each room in each customer's home, calls for a somewhat broader training than the average utility salesman is accustomed to. But the salesman does not object to that. When a hazard threatens his job he will work at sales innovations with a will.

"All-Out Aid to Better Seeing" is the name of the new program, which is to extend for three to five months. During that time the salesman is to make five lighting calls per day, reaching the company's total 72,000 metered customers. Dealers are enthusiastic, because it will send customers into their stores with materials carefully prescribed in hand. Manufacturers are pleased, because much of the materials used in the campaign have little to do with priorities. And salesmen, according to R. B. McElroy, general sales manager, have been aroused from past weeks of gloomy uncertainty and are "rarin' to go."

Preparatory to the start of the program, salespeople were called in for a comprehensive lighting conference. Effects of the defense program on selling were explained, also the employee-company need for a lighting program. Lighting standards in each room of the modern home were defined by experts. Skits emphasized pitfalls that yawned for the uninformed. Films on lighting were shown; the group adjourned to an old-fashioned kitchen, bedroom, living room, dining room and bath, where glare, shadow, improper placement and inadequate light were streamlined to accepted comfort and beauty standards by specialists. Teams were chosen, and these groups were given photographs of unlighted homes to contest for the best presentation that was possible. Realizing that home improvement includes more than lighting arrangements, the company brought interior decorators into the conference to teach the salesmen fundamentals of color harmony, things to watch in recommending wall paper, carpeting and the arrangement of furniture, draperies, etc. When the conference ended, salesmen were fairly well qualified to knock on Mrs. Customer's door.

Prescription Booklet

Important to the lighting adviser as a sales tool is the prescription booklet designed to be left in the customer's home. This booklet is a personalized recommendation for each room of the home. The outside corner carries the hand-inscribed name of the customer. The next page briefly tells what light will do by way of beauty, eyesight protection and health; the third page tells what good light is, showing all types of lamps, lighting fixtures and adapters for light conditioning. Under all material illustrations are key letters and catalogue data. Pages follow devoted to various rooms, cross-hatched space

[*Continued on page 119*]

SALESPEOPLE of the Washington Water Power Company check up on adapter procedure for selling, one of many steps in broadened residential lighting program

Dual-Pressure Turbine Fits Into Boiler Program

New 37,500-kw. turbine for Indianapolis plant designed to operate on either 400 or 800 lb. steam pressure — Initial operation is with 400-lb. steam at reduced rating — Wells back up spray tower and river water to supply condenser circulating water

A. A. BENSON, Engineering Department, Indianapolis Power & Light Company, Indianapolis, Ind.

TO KEEP its system capacity ahead of growing power requirements for defense production in Indianapolis and increase efficiency of its principal generating station Indianapolis Power & Light Company put into operation last month (September) at Harding Street plant a new 37,500-kw., hydrogen-cooled turbo-generator. The new unit (General Electric), to be known as No. 3, can be operated with steam at either 400 lb. pressure, 700 deg. temperature or 850 lb. pressure, 900 deg. temperature. This unique arrangement has permitted immediate addition of approximately 17,000 kw. to plant capacity, through use of excess steam available from existing boilers, while a 400,000-lb.-per-hour high-pressure boiler is being currently installed. When the new boiler is completed, early in 1942, the full capacity of the new machine will be realized.

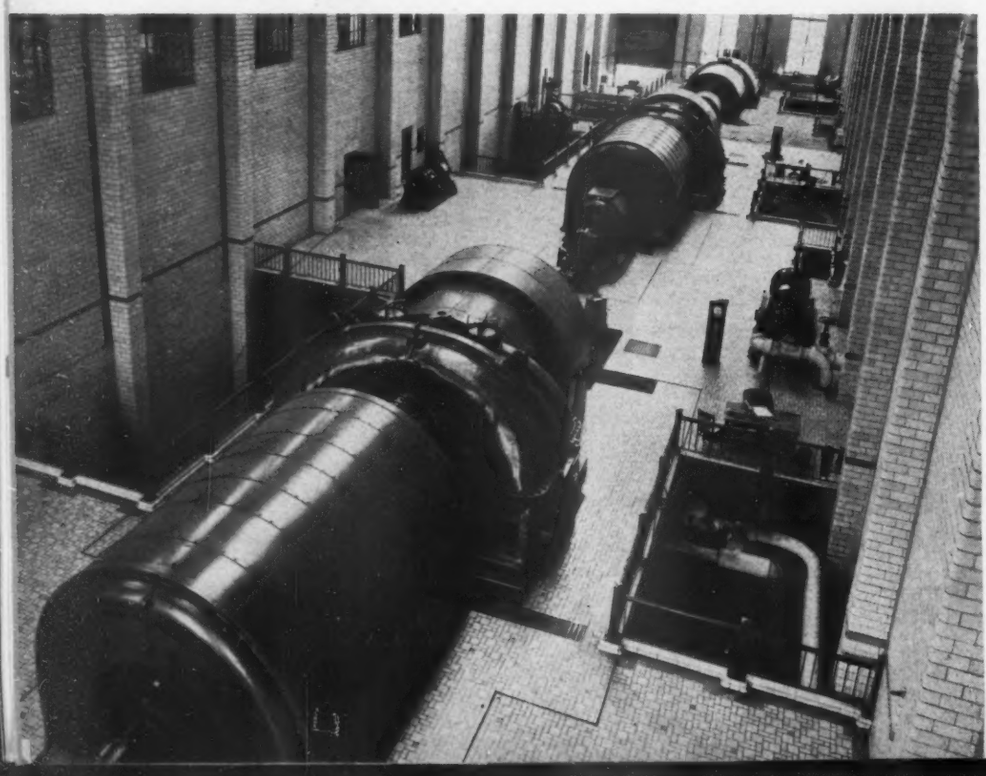
In addition to a unique tee-header and governor arrangement, which permits the unit to operate on either of two pressures, by control of motor-operated gate valves from the turbine gage board, the Harding Street extension has a number of other features. Major among these are a condenser circulating water supply, using well and river water backed by a spray tower to guard against low-river flow; a 400,000-lb.-per-hour three-drum, slag-bottom, steam-generating unit using pulverized Indiana strip-mine coal and equipped with full automatic combustion control, and a flexible feedwater system permitting ready expansion.

Harding Street plant was first placed in operation early in 1932 with two 36,750-kw. Westinghouse condensing type turbo-generators and eight 450-lb., 725-deg., stoker-fired boilers. It was designed to have four units ultimately or 147,000 kw. capacity.

When load surveys indicated, in the last half of 1939, that additional generating capacity was needed, recommendations were to install a new 37,500-kw. machine to operate on steam from existing boilers, this unit to provide spinning reserve during machine inspection and some increase in capacity due to excess boiler capacity. At the time additional steam-generating capacity to serve the unit was not justified. By the latter part of 1940, however, the rapid increase in demand, due to national defense conditions, justified the additional steam capacity.

At that time it was decided that No. 3 unit was to be a 3,600-r.p.m., tandem-compound machine with double-flow exhaust and with a 35,000-kw. main hydrogen-cooled generator and a 2,500-kw. air-cooled house generator, on the same shaft. A separate 150-kw. motor-driven exciter set was provided for the main generator. This duplicated the two existing units in arrangement, the only difference being that they were 1,800 r.p.m. and air-cooled with 1,750-kw. house generators. The increased house generator size for the new machine provided

TURBINE ROOM at Harding Street plant. The new No. 3 unit is at the far end surrounded by unfinished floor



power for coal pulverizing. It was specified that the turbine was to operate initially on steam from existing boilers at 400 lb. pressure, 700 deg. temperature, but provide for future operation on steam at 850 lb. pressure, 900 deg. temperature from additional boiler capacity.

Dual Pressure Operation

To take full advantage of the dual-pressure feature unit No. 3—the new machine—is supplied from a tee-header having one side arranged for connecting to the 850-lb., 900-deg. boiler No. 9 (when completed), and the other side connected through a 14-in. pipe to the 400-lb., 700-deg. F. steam header supplying units Nos. 1 and 2.

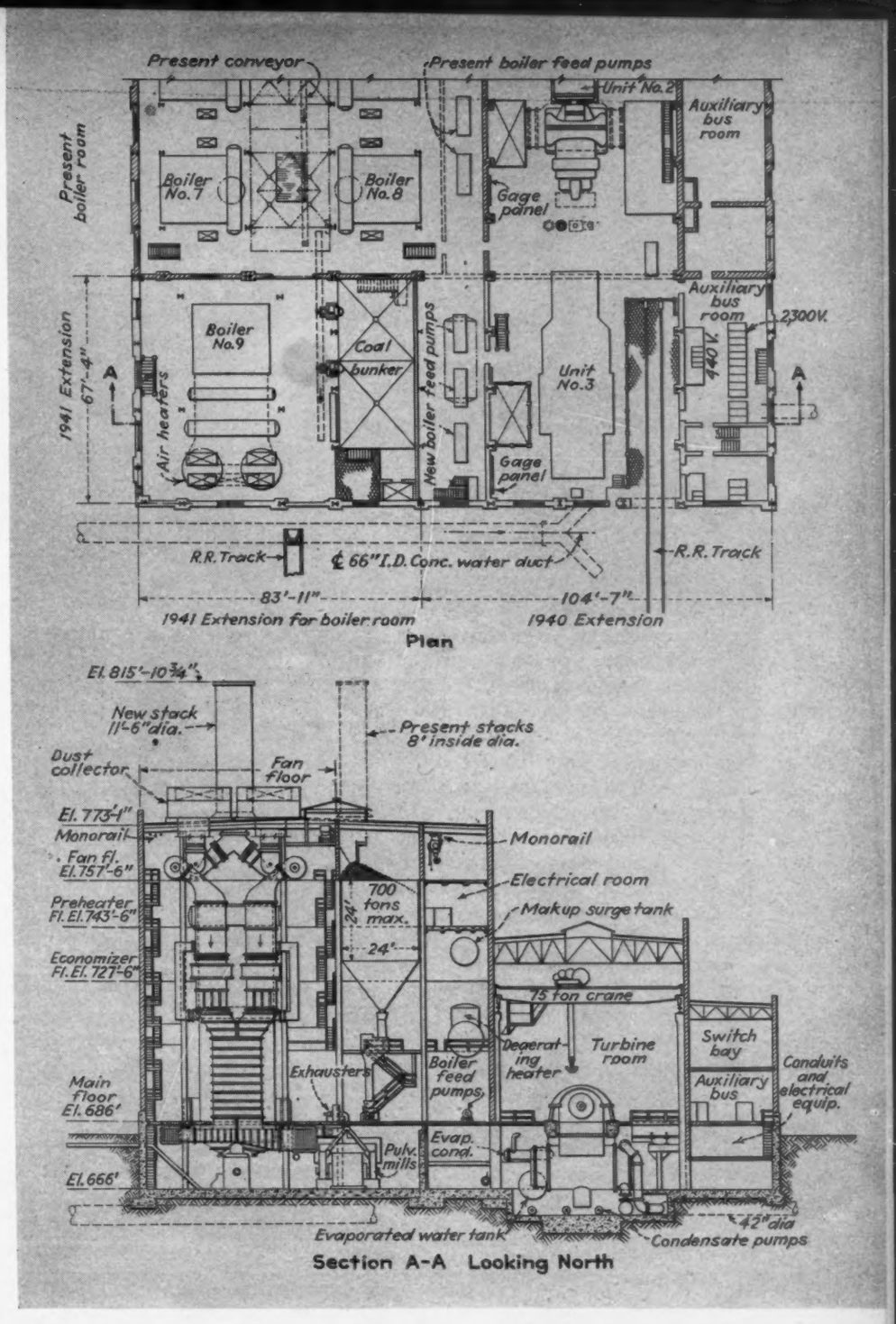
Each side of the tee has a motor-operated gate valve controlled from unit No. 3 turbine gage board. In addition to the motor-operated gate valve the 14-in. cross connection also has a check valve that allows steam to flow only toward unit No. 3.

When the new high-pressure boiler is connected (in 1942) the turbine operator will be able to supply the new turbo-generator from either steam source via the motor-operated valves. Calculated temperature difference in the first stage shell, when changing from one pressure to another, is 20 deg. minimum at 2,000 kw. load and 140 deg. maximum at full load.

Governing mechanism on the dual-pressure turbine is equipped with a shifting fulcrum on the governor linkage arm that locks into position, allowing only eight of twelve valves to open when the unit is supplied with 850-lb. steam. This is to prevent opening of overload valves and overloading the machine. When the unit operates on 400-lb. steam the latch releases and the fulcrum can be shifted manually to bring four additional valves into service. Should steam pressure rise again to 850-lb. pressure the fulcrum will automatically shift and latch in place to prevent opening the four extra valves.

Circulating Water Problem

Condenser circulating water at Harding Street is supplied from the White River. Because this water is subject to temperatures as high as 88 deg. F. in summer and because minimum flow is at times as low as 45,000 g.p.m., there are a number of innovations in the supply system, to guard against low river flow. Present units require 35,000 g.p.m. per condenser and the new unit 32,000 g.p.m. for its condenser.



GENERAL PLAN and cross-section of Harding Street plant shows turbine room extension of 1940 and boiler room extension of 1941

To insure ample water supply during low-river flow periods in summer months for two units operating at full load a 25,000-g.p.m. spray tower was constructed during 1938. Further to augment the condenser water supply in the event of low flow four gravel-packed wells 54 in. in diameter and 100 ft. deep were installed, each having a capacity of about 3,000 g.p.m. This well water, at approximately 55 deg. F., will be mixed with river water in a screen chamber at the crib house as required to hold river water temperature during low flow and recirculating periods below 88 deg. at pump suction.

The well system has an advantage over the spray tower in lower pumping costs and, based on a 16-deg. temperature rise through condenser above 88 deg., has about three times river water capacity for absorbing

heat. For example, with units Nos. 1, 2 and 3 in service total water required is 102,000 g.p.m. at 88 deg. This can be supplied as follows: 45,000-g.p.m. river water at 88 deg., 25,000-g.p.m. water from spray tower recirculated at 88 deg., and the balance made up of 21,600 g.p.m. of recirculated water at 104 deg. plus 10,400 g.p.m. of well water at 55 deg., which when mixed together will make up the balance of 32,000 g.p.m. at 88 deg. F.

Power for Water Pumping

Power consumption for spray tower operation, by test, proves to be around 0.456 kw.-hr. per 1,000 gal. of water pumped. Power consumption for well pumps is estimated to be a maximum of 0.362 kw.-hr. per 1,000 gal. of well water. On the basis of three to one heat-absorbing capacity the actual comparative cost of well water power consumption is only $0.362 \div 3$, or 0.121 kw.-hr. per 1,000 gal. The much lower power consumption of the wells makes them preferable sources of condensing water, although the first cost of installation will be somewhat higher than the spray tower.

During the latter half of 1940, when the need for additional steam-generating capacity became obvious, a single boiler, rather than two half-capacity boilers, and a pulverized fuel method of firing were chosen to supply unit No. 3. A slagging type furnace bottom was selected because the slag ash was easier to dispose of and because the allocated load forecast indicated that the new boiler could be kept on base load. The 400,000-lb.-per-hour continuous capacity is slightly in excess of the requirements of 37,500-kw. unit No. 3 at 0.8 power factor. However, unity power factor can be approached by carrying the reactive load on one of the other machines, allowing the more efficient No. 3 machine to be operated at higher output capacity, approaching 400,000 lb. per hour steam demand.

The new boiler is a Combustion Engineering Company three-drum type with fully water-cooled slag-tap furnace, tangentially fired and supplied with pulverized fuel from two Foster Wheeler Corporation Harding-type ball mills. Two Ljungstrom air preheaters, two Sturtevant forced-draft fans, two American Blower induced-draft fans and two sixteen-unit Buell dust collectors complete the boiler auxiliary equipment.

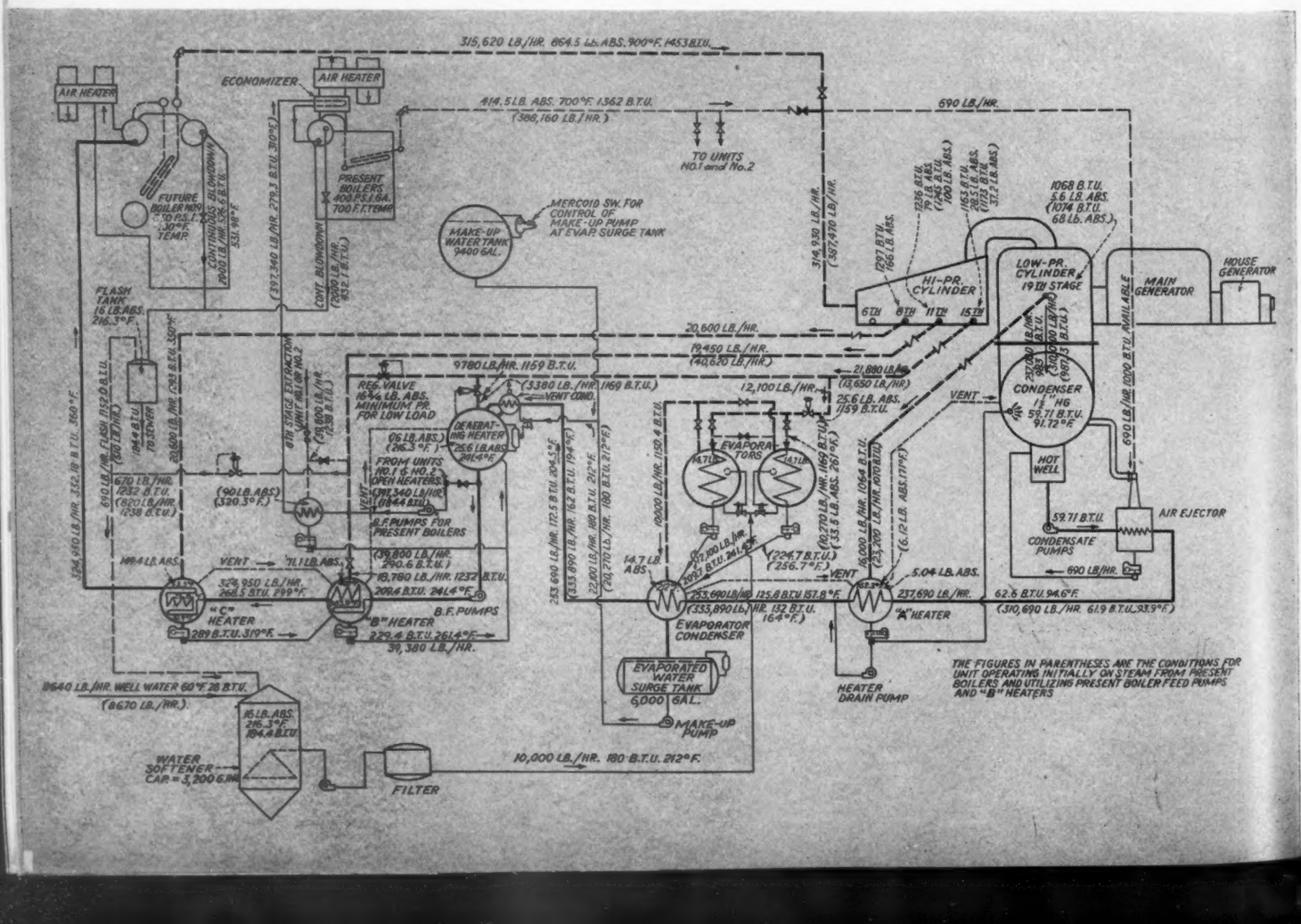
The entire boiler was organized in a building the same height as the present boiler room. Coal bunkers had to be offset somewhat, as shown, in order to give clearance to soot blowers and working space around the side of the boiler.

Final gas temperature to stack is limited to a minimum of 350 deg. F. because of tendency to form corrosive condensation in air preheater plates and gas duct work.

Fuel is Southern Indiana strip-mined coal, having a heat content averaging about 11,200 B.t.u. as fired. The high moisture content

HEAT BALANCE STUDY shows new dual-pressure unit operating from existing boilers, also operating in conjunction with future boiler now under construction. Note tabulation of heat rates

	Initial With Present Boilers	Future With Boiler No. 9
Full load output, at 0.80 p.f., kw	36,750	37,500
Internal kw. developed on heat balance, kw	38,110	38,460
Output kw. after deducting 1,010 kw. losses, kw	37,100	37,450
Heat rate of turbine, including jets, B.t.u.	11,290	9,390
Auxiliary power required total, kw	1,470	1,875
Output kw. less auxiliary power, kw	35,630	35,675
Gross heat rate excluding boiler efficiency, B.t.u.	11,750	9,860
Boiler operating efficiency, percent	76	85
Plant heat rate, incl. boiler efficiency, B.t.u.	15,450	11,600


315,620 LB./HR. 864.5 LB. ABS. 900°F. 1453 B.T.U.
AIR HEATER
ECONOMIZER
AIR HEATER
414.5 LB. ABS. 700°F. 1362 B.T.U.
(386,160 LB./HR.)
690 LB./HR.
TO UNITS NO.1 and No.2
PRESENT BOILERS 400 P.S.I. 684 700 F.T. TEMP.
FUTURE BOILER NO.3 650 P.S.I. 730°F. TEMP.
CONTINUOUS BLOWDOWN 2900 LB./HR. 536.6 B.T.U. 331.98°F
CONT. BLOWDOWN (7000 LB./HR. 432.2 B.T.U.)
(397,340 LB./HR. 279.3 B.T.U. 310°F.)
MERCOID SW. FOR CONTROL OF MAKE-UP PUMP AT EVAP. SURGE TANK
MAKE-UP WATER TANK 9400 GAL.
314,930 LB./HR. (387,470 LB./HR.)
1297 B.T.U. 166.1 LB. ABS.
1236 B.T.U. 79.1 LB. ABS. (1245 B.T.U. 100 LB. ABS.)
1153 B.T.U. 68.3 LB. ABS. (1163 B.T.U. 82.2 LB. ABS.)
1068 B.T.U. 5.6 LB. ABS. (1074 B.T.U. 68 LB. ABS.)
HI-PR. CYLINDER
6TH 8TH 11TH 15TH
LOW-PR. CYLINDER 19TH STAGE
MAIN GENERATOR
HOUSE GENERATOR
FLASH TANK 16 LB. ABS. 216.3°F.
20,600 LB./HR.
19,450 LB./HR. (40,620 LB./HR.)
21,880 LB./HR. (43,650 LB./HR.)
9780 LB./HR. 1159 B.T.U.
REG. VALVE 15.4 LB. ABS. MINIMUM PR. FOR LOW LOAD
(3380 LB./HR. 1169 B.T.U.)
VENT COND.
12,100 LB./HR.
25.6 LB. ABS. 1159 B.T.U.
CONDENSER 1½" HG 56.71 B.T.U. 91.12°F.
VENT
690 LB./HR. 1090 B.T.U. AVAILABLE
DEAERATING HEATER 255 LB. ABS. 261.4°F.
65 LB. ABS. (286.3 °F.)
FROM UNITS NO.1 & NO.2 OPEN HEATERS. (391,340 LB./HR. (1844 B.T.U.)
EVAPORATORS
14.7 LB.
HOT WELL
59.71 B.T.U.
AIR EJECTOR
CONDENSATE PUMPS
690 LB./HR.
B.F. PUMPS FOR PRESENT BOILERS
(90 LB. ABS. (320.3°F.)
109.4 LB. ABS.
VENT
71.1 LB. ABS.
(39,800 LB./HR. 290.6 B.T.U.)
(8,780 LB./HR. 1232 B.T.U.)
209.8 B.T.U. 244.4°F.
324,950 LB./HR. 268.5 B.T.U. 299°F.
"C" HEATER
289 B.T.U. 319°F.
"B" HEATER 229.6 B.T.U. 261.4°F. 39,380 LB./HR.
B.F. PUMPS
(10,000 LB./HR. 1159.4 B.T.U.)
(20,270 LB./HR. 180 B.T.U. 212°F.)
(333,890 LB./HR. 162 B.T.U. 194°F.)
(333,890 LB./HR. 172.5 B.T.U. 204.5°F.)
(27,400 LB./HR. 309.2 B.T.U. 241.5°F.)
(224.7 B.T.U. (256.7°F.)
14.7 LB. ABS.
EVAPORATOR CONDENSER
253,690 LB./HR. 125.8 B.T.U. 151.8°F.
(333,890 LB./HR. 132 B.T.U. 164°F.)
(10,270 LB./HR. 1159 B.T.U. (33.5 LB. ABS. 261°F.)
46,000 LB./HR. 1064 B.T.U. (23,200 LB./HR. 1010 B.T.U.)
(6.12 LB. ABS. 171°F.)
5.04 LB. ABS.
237,690 LB./HR.
"A" HEATER
62.5 B.T.U. 94.6°F. (310,690 LB./HR. 61.9 B.T.U. 93.9°F.)
THE FIGURES IN PARENTHESES ARE THE CONDITIONS FOR UNIT OPERATING INITIALLY ON STEAM FROM PRESENT BOILERS AND UTILIZING PRESENT BOILER FEED PUMPS AND "B" HEATERS
EVAPORATED WATER SURGE TANK 6,000 GAL.
MAKE-UP PUMP
HEATER DRAIN PUMP
8640 LB./HR. WELL WATER 60°F. 28 B.T.U. (8670 LB./HR.)
15 LB. ABS. 216.3°F. 194.4 B.T.U.
WATER SOFTENER CAP. = 3,200 G.P.M.
FILTER
10,000 LB./HR. 180 B.T.U. 212°F.

(around 13 percent) of this coal necessitated highly preheated air temperature (550 deg.) to dry the coal properly. It was found that economizers were unnecessary.

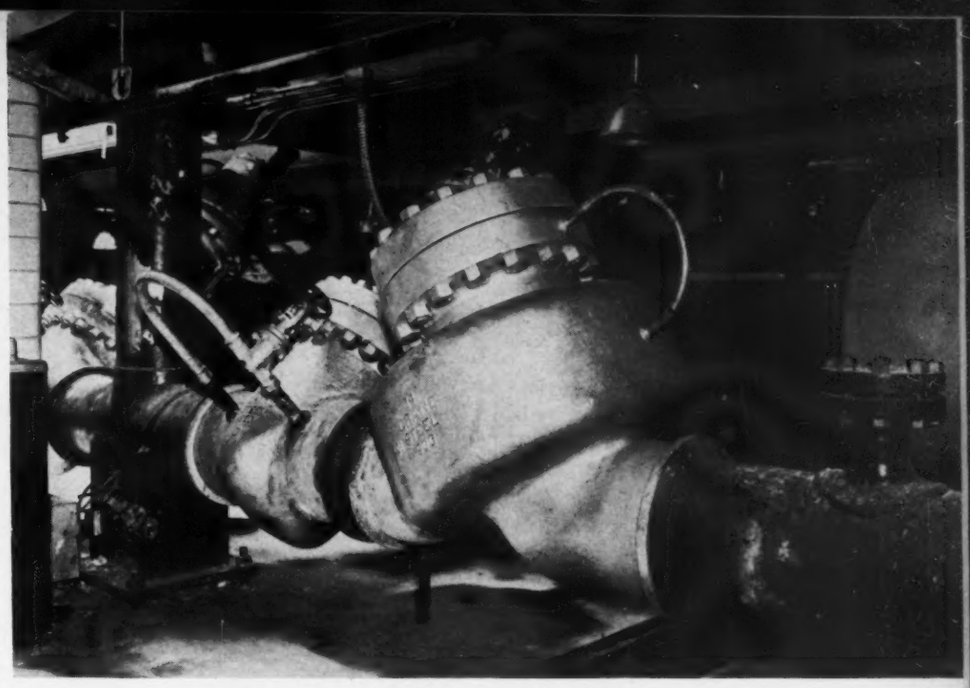
Make-up water is supplied from wells adjacent to the plant, treated in hot process lime soda softener and vaporized in the evaporators. Make-up will average about 2 to 2½ percent of water flow to boilers. Internal phosphate feed to drum with chemical pumps will be used in the event condenser leakage should occur.

Feedwater System and Heaters

The 1940 extension for unit No. 3 provided for a low pressure "A" heater; two evaporators, for either single or double effect service; one evaporator condenser, and a 400,000-lb-per-hour, zero-oxygen deaerating heater. The outlet from the deaerating heater was cross-connected to outlets from open heaters on Nos. 1 and 2 units, forming a common suction pump header. From here the present boiler feed pumps pump through the present "B" heaters on Nos. 1 and 2 units to the present 400-lb. boilers. A cross-connecting extraction line was added from the eleventh-stage of No. 3 unit to the present "B" heaters on units Nos. 1 and 2, so that the new machine can replace either of the two present machines, whichever may be out of service. When the new high-pressure boiler is installed three new boiler feed pumps, together with a new high-pressure "B" heater and one high pressure "CW" heater, will also be installed, as indicated in the illustrations, and unit No. 3, together with the new boiler, will operate as a complete separate unit from the balance of the plant.

Heat Balance

Under initial operation the new unit gives maximum efficiency at three-quarter load, 0.8 power factor, while under future conditions on 850 lb. steam pressure maximum efficiency will be at full load, 0.8 power factor. Some slight sacrifice in efficiency under 400-lb. operation was necessary to get maximum efficiency with 850-lb. steam. This loss is because of the greater volumetric flow of steam through the unit and the higher leaving loss in exhaust to the condenser. However, the unit has a slightly lower heat rate than existing plant units, principally because of the lower generator loss due to hydrogen cooling of the main generator.



CHECK AND GATE VALVES on high-pressure header supplying new unit

From left to right are: 14-in. motor-operated gate valve, to which the new 400,000-lb.per-hour boiler will be connected; tee header, with 14-in. main steam riser to new dual-pressure turbine; 14-in. gate valve for 400-lb. steam supply; 14-in. check valve, allowing steam to flow only toward tee, and two of the four 4-in. flanged nozzles for relief valves protecting 14-in., 400-lb. header.

Under initial operation the deaerating heater is made to balance its pressure with open heaters on the two existing units because of common boiler feed pump suction. This is attained by passing the fifteenth-stage extraction steam through a 12-in. pressure-regulating valve located at deaerating heater, maintaining heater at 16 lb. absolute pressure. This reduced the amount of steam bled from the fifteenth stage and increases that bled from the eleventh stage with some slight sacrifice in heat rate. The deaerating heater pressure will vary with that of the fifteenth stage pressure and bring the temperature of condensate to boiler feed pumps higher, tending to equalize the extraction steam from eleventh stage. In addition the new "B" and "C" heaters will have a cooler section which will cool drains from heaters to a point 20 deg. above the temperature of entering boiler feedwater.

All auxiliary motors operate from either 440-volt or 2,300-volt a.c. Each house generator feeds directly to its corresponding "T" bus at 2,300 volts. This, in turn, supplies the turbine auxiliaries and also the boiler room auxiliary bus section. A duplicate bank of 2,300/440-volt transformers, fed by each unit bus, supplies the necessary 440-volt auxiliaries below 50 hp. in size.

For starting-up purposes each two machines have available a 2,300-volt general bus which is fed from the 132-kv. outdoor system by a 132-kv./2.3-kv. service transformer. Each turbo-generator unit supplied with steam is arranged to supply the motors necessary to operate the corresponding four boilers. General auxiliaries, which have to operate when the machine may be out of service, are supplied from the general bus.

Buses Cross-Connected

In order to operate unit No. 3 initially and from existing stoker-fired boilers Nos. 1 to 8 it was necessary to cross-connect the No. 3T auxiliary bus to the No. 1T auxiliary bus feed to boiler room bus section No. 1, to the No. 2T bus feed to boiler room bus section No. 2 and to the general auxiliary bus No. 1G. With this arrangement and proper interlocks No. 3 machine can take over the duty of either unit No. 1 or 2, as the case may be, supplying their corresponding auxiliary buses and in turn being supplied with steam from the corresponding set of boilers.

The main generator output is tied directly through three 132,000/13,200-volt step-up transformers to the main duplicate 132-kv. outdoor bus. This duplicate outdoor bus has four outgoing lines at present, with provisions for one additional outgoing line and two backfeed systems into the plant for supplying general auxiliary bus No. 1G and No. 2G.

Protective Grounding of Movable Heavy Machines

System isolated from ground protects against shock, but allows no discrimination in protection of energy supply —Impedance grounded neutral combines both protections

D. STOETZEL, Industrial Department, General Electric Company

ONE MIGHT naturally think that a huge machine on steel to the ground would be electrically grounded. Some are—sometimes. A typical case of an insulated unit is an electric shovel in a marble quarry or a large motor-driven unwatering pump, mounted on timber skids. In most places where shovels, drag-line excavators, tower conveyors and portable hoists, saw mills and pumps are used conditions as to natural grounds will vary greatly over small areas. Between insulating rock beds are found vertical or horizontal seams of wet clay or other good conducting material. There have been enough records of severe shocks and fatal accidents around high-voltage portable machinery to indicate that a real hazard may be at hand.

Dangerous Potentials Possible

Unless the power supply system is designed to provide adequate protection, faults—not bad enough to cause burn-outs or shut-downs—may bring the whole machine up to a dangerous potential near the applied voltage, say 550, 2,300 or 4,000. An operator about to board the machine or undertaking repairs may be severely shocked by contact with the insulated machine if he is standing on conducting material. Again, without touching the machine, a man may be shocked by stepping across an insulating barrier that allows a voltage gradient to build up in the vicinity of the machine because of an electrical fault.

The successful grounding of equipment in the class outlined is not a simple matter, especially where several machines are operated from the same power system. Economical, safety-assuring grounding is attained in different ways as systems, units and circumstances vary. Each case requires special study if a well-engineered grounding system is to be applied.

To assist in visualizing the source of the voltage hazard, a circuit diagram of a typical system, together with an equivalent impedance network, will be helpful. Such a typical system (a) and an equivalent electrical-impedance network (b) are shown in the accompanying illustration. The system includes a main step-down transformer station to which power is fed by a high-tension line, and from which low-tension power is distributed over an overhead open transmission primary. From several points on these lines unit feeders are taken to the various shovels by means of three- or four-conductor trailing cables.

With an ungrounded power supply system [(a) with $Z_g = \text{infinity}$], a line-to-ground fault on one phase involves no particular hazard. However, a fault to ground on another phase, when one ground is on the shovel and the other is off the shovel, will cause a heavy flow of current from shovel frame to ground, with possibly dangerous voltage appearing between shovel and ground. It should be noted that R_4, the resistance between the shovel frame and ground, may be of a relatively high value, depending on the nature of the soil and the contact the shovel treads make with it.

Protection for the ungrounded system is relatively simple and inexpensive and consists merely of the best and most reliable type of ground-detector equipment with provision for cutting power off the shovel circuit immediately when a ground appears any place on the system.

Grounded Neutral

If the solidly grounded neutral scheme is used conditions may exist as illustrated in (a), with Z_g relatively small and R_1 and R_4 relatively large. It is apparent that the man may encounter dangerous potential in the case of a line-to-ground short on the machine. The solidly grounded neutral system is subject to heavy ground currents, therefore subject to high voltage gradients in the ground return circuit.

By increasing Z_g to limit the ground current to a value just sufficient to assure reliable operation of protective devices, and reducing Z_5 plus Z_4 to a sufficiently low value, we get a condition where the voltage appearing across R_4 is low enough so that it may be considered not dangerous to human life. This is what is known as the impedance grounded neutral system, which is widely recommended and used where the best type of protection is required.

Ungrounded Neutral

Ungrounded neutral operation cannot be readily arranged to provide selective tripping of the feeder circuit in ground fault trouble and therefore is usually suitable only for systems involving relatively few feeders. Since operation is curtailed on

the occurrence of a ground any place on the system, much valuable time may be lost on a large system before the breakdown can be located and remedied.

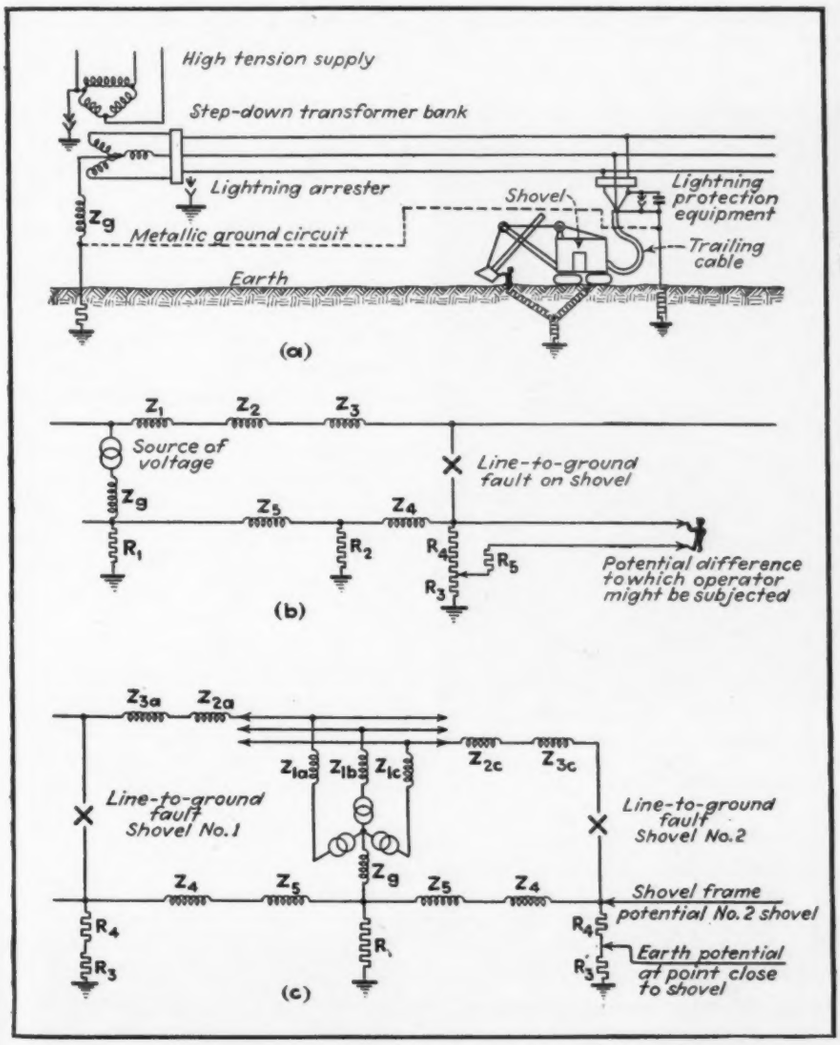
Impedance grounding provides conditions under which protective equipment may be arranged to trip off only the circuit which is in trouble. In case of failure of an individual relay or circuit breaker to open the feeder on which a ground exists, "back-up" protection may be provided to cause the main line circuit breaker to open and shut down the entire system.

The limited ground current arrangement is similar in many respects to an ungrounded neutral system except that a definite amount of ground current is permitted to flow when a line-to-ground fault occurs, and protection is obtained against the possibility of excess voltage due to arcing grounds.

Effectiveness of both the ungrounded-neutral and the limited-ground current systems, in so far as shovel-operator shock hazard is concerned, will be lost if simultaneous consecutive grounds occur. In the case of two simultaneous-consecutive ground faults at different locations a line-to-line short circuit results, involving the ground-return circuit, and circulating current is limited only by the normal power-circuit impedances.

It is to be noted that simultaneous-consecutive ground faults at one given location do not destroy the effectiveness of the protective arrangement, inasmuch as the fault current does not flow through any appreciable length of the ground-return circuit.

The term "simultaneous-consecutive ground faults" is used to identify double-line-to-ground faults occurring (consecutively or simultaneously) on two phases (usually, but not necessarily, the one the result of the other) and continuing simultaneously.



TYPICAL supply system (a) and equivalent impedance networks: (b) single ground fault, (c) simultaneous-consecutive faults

Z_1 = Effective impedance of the supply system, including step-down transformer.
Z_2 = Effective impedance of the overhead distribution line.
Z_3 = Effective impedance of the line conductors in the trailing cables.
Z_4 = Effective impedance of the ground-return conductor in the trailing cable.
Z_5 = Effective impedance of the metallic ground-return circuit from the trailing cable to substation ground terminal.
Z_9 = Effective impedance of the ground-current limiting device at substation.
R_1 = Grounding resistance at substation.
R_2 = Resistance of the grounding terminal at pole-line end of trailing cable.
R_3 = Effective earth resistance between the junction of R_4 and R_5 to mean earth potential.
R_4 = Effective contact resistance between the shovel treads and the immediately surrounding earth.
R_5 = Effective contact resistance between a man and the earth on which he stands.

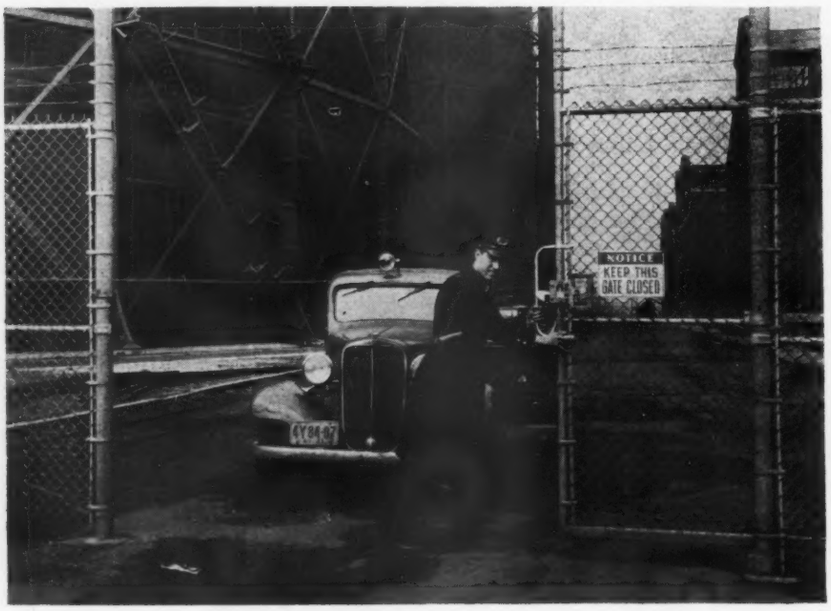
Multiple Faults

The general characteristic is illustrated in (c), in which it is assumed that shovel No. 1 developed a fault between phase "A" and ground, and while this fault continued another at shovel No. 2 occurred between phase "C" and ground. It is evident that a line-to-line fault circuit has been established involving line conductor "A" at shovel No. 1, the ground-return system between the frames of shovels No. 1 and No. 2, and line conductor "C" at shovel No. 2. Even in the case of distribution systems at relatively moderate voltages the voltage in the ground-return circuit between the substation grounding point and the frame of one of the shovels in fault may be many times that of the permissible shovel-to-ground potential which is considered safe.

In view of the undesirable effects of simultaneous-consecutive grounds and the difficulty of obtaining protection in these cases, it is recommended that the system insulation be given the best possible maintenance in order to reduce to a minimum the possibility of such multiple grounds occurring at remote locations. Inasmuch as normal insulation failure is a function of both voltage and time, a system which provides automatic isolation of the first unit on which a line-to-ground fault occurs will have fewer cases of simultaneous-consecutive grounds than a system in which automatic ground-fault isolation is not provided.

Utility Employees Enlisted in Anti-Sabotage Army

Lectures and posters call attention of 35,000 utility workers to importance of maintaining uninterrupted service — Special patrolmen, carefully selected from employee ranks, guard all properties



SQUAD CARS, equipped with searchlights, aid employee patrolmen in keeping their 24-hour vigils on extensive utility properties

THE Consolidated Edison Company of New York, Inc., is not looking for trouble. It does not vision hordes of enemy bombers droning over the various power plants and other properties of the system. It does not fear prolonged visits from saboteurs or extended subversive activities.

Just the same, it realizes that mishaps will happen, as they have happened on other utility systems recently. This is particularly well to keep in mind in view of the territory served by Consolidated Edison System companies—the New York metropolitan area. Already accidents have happened which might have had more serious consequences, if Consolidated had not perfected its plans to guard against sabotage.

These plans, incidentally, were begun more than a year and a half ago, about the time that J. Edgar Hoover of the Federal Bureau of Investigation was warning the members of the American Institute of Electrical Engineers and other engineering societies of the imminence and seriousness of sabotage potentialities in the United States.

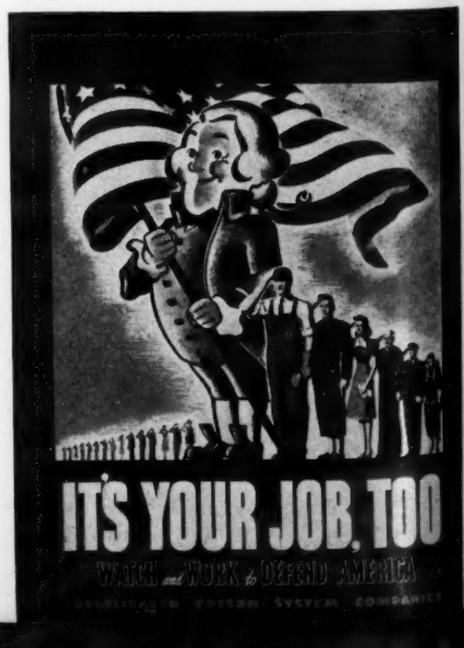
Federal Sabotage Law

Federal support of these plans is furnished by the present version of the "sabotage law" of 1918, which protects public utilities against "willful injury or destruction of war material . . . war premises or utilities used in conjunction with war material." Heavy fines, long imprisonment, or both, are the teeth in this law.

On the mechanical side, precautionary measures include steel- and barbed-wire fences around the company properties, some of which are floodlighted after dark; credential regulations to keep unwelcome visitors off company premises; routines governing the checking of deliveries, and temporary partitions set up on construction jobs as restricted zones to separate construction and operating crews and areas.

Backing up these measures, however, Consolidated has enlisted the services of its 35,000 employees, chiefly through the use of lectures and posters. Lectures are given periodically at company auditoriums and other regular assembly places on the properties. The audiences are made up, usually, of the employees in a single department. Company speakers stress the importance of

POSTERS bring home the plain facts of the



maintaining an uninterrupted supply of electricity, gas and steam to defense industries and remind the listeners that this is their job, too. To date, most of these talks have been made by an officer in the company's insurance and safety department, helped out, when lecture schedules made it necessary, by some of his assistants.

Other talks warn the employees to be on the lookout for saboteurs, fifth columnists and suspicious "accidents" on the job, and ask their cooperation in detecting subversive activities. While these lectures are all of a serious nature and point out the personal hazards to the employees if the acts go undetected, no attempt is made to "panic" the workers. As the company puts it, this program is an unusual phase of a usual job—employee education.

Posters Constant Reminders

These lectures are supplemented by posters. More than 2,000 colored posters, issued every two weeks and placed on bulletin boards throughout the system—in office buildings, generating stations, substations, shops, service and commercial buildings—urge employees to be on the alert for bombs, suspicious characters and sabotage. Typical poster headlines are: "Safeguard Power for the Battle of Production," "Make Watchfulness a Habit," "Stop the Saboteur," "Watch Out While You Work." Other posters describe in detail procedures in emergencies—what to do with bombs— and are placed in company buildings.

One poster, in a prominent position throughout the system, is intended to be left up indefinitely. This carries the text of the federal sabotage act and the penalties imposed for breaking it. It also reminds the employees of the company rewards offered "for information leading to the arrest and conviction of any person or persons violating, or planning to violate," any of the provisions of the law which apply to the system's properties and facilities.

Special Patrols

The special patrolmen — 200 in number—who guard company property night and day were selected from the employee personnel. These men wear special blue uniforms, Sam Browne belts, badges and are armed with revolvers. They are all 30 years of age or older and at least 5 ft. 7 in. in height. Chosen from employee ranks, with an eye to health, military background and alertness of mind, the men were trained in the use of firearms by instructors from New York City's police department and they practice on the department's pistol range.

Police instructors have also lectured them on bombs and explosives, how they're made, what to do with them, and, more to the point, what *not* to do with them. They have been

[*Continued on page 121*]

VISITORS to utility plants are checked in and out; both identification card and permanent station register are looked at by station attendant, who carries an identifcation button of his own

problem, supplement periodic lectures. All are colored, most of them in red-white-and-blue motifs

STOP HIM
You can help defense by preventing sabotage!
BE ON THE ALERT
Help prevent sabotage by promptly reporting any suspicious person or act!
STAMP IT OUT!
... SABOTAGE menaces your lives and national defense
CONSOLIDATED EDISON SYSTEM COMPANIES

Editorials

S. B. WILLIAMS, *Editor*

Charters of Exploitation

MEN SEEK always to improve occasions to forward their own purposes. Opportunities for such capitalization of conditions abound in the emergency of defense preparation.

Undoubtedly many business men are using the defense emergency for profit in ways that deserve condemnation. But the freedom of business is being so circumscribed by defense regulation and taxes that large opportunities for profit in the emergency are practically non-existent.

While business is being thus restricted, other elements in the national economy have been given what now amount to charters of exploitation. The behavior of labor, under the provisions of the Wagner Act and countenanced by governmental indulgence, has made it evident that it is using the emergency as an opportunity to enforce its demands.

Those forces in government that are working toward public ownership and operation and that have been so helpfully implemented by the Administration are also wringing every advantage they can from the defense emergency. The Rural Electrification Administration is the latest outstanding example.

REA was created by the Congress as an agency to bring electric service to farmers not being served or who could not get service so quickly or who might not get it at all if rural electrification remained wholly a matter of business economics. Although criticised at times as a manifestation of government paternalism, most reasonable men recognized REA as an effort toward a worthy objective. But now, by perversions of the intent in its creation and by skin-of-the-teeth interpretations of the law, REA departs from its designed purpose and uses the defense banner as a cover for direct competition with established business.

We now see REA engaged in an ambitious program, some of it already in construction, to set up groups of cooperatives to compete with established utilities for present and future customers, not farm customers, but industrial, commercial and residential customers. We see REA working to serve small communities though they may now be served by some utility.

At budget-making time this spring a Congressional committee urged upon REA Administrator Harry Slattery a hundred million dollars for the new fiscal year when he was asking for only forty millions. One can understand the disinclination to pare down a staff that has been a long time being built, especially if the money is available, and when it is almost a political crime not to spend appropriations in the allotted time.

But whole businesses in which men have placed their lifetime savings have had to close down and see their staffs scattered to the four winds of industry. Is it fair that the very government that has created conditions that caused those shutdowns should allow to itself or any part thereof any more favorable treatment?

Charters of exploitation, be they in government, labor or business, should be ruled out during this emergency.

FPC Unit Cost Data— A Tonic or a Poison

A VERY VALUABLE REPORT on utility cost units and ratios was issued last month by the Federal Power Commission. Other industries have had statistical cost comparisons that have guided individual operations where they may have been above or below average, but the electric utilities have until now not had the advantage of such data in any extended or substantial form.

Other industries secure cost data through associations, or independent agencies, that depend upon the cooperation of the reporting companies. In such instances the data are frequently fragmentary and sometimes not entirely comparable because of non-uniformity in accounting practice. In the present instance, however, the data are secured as a part of the regulatory process and because of uniform accounting are comparable as to cost allocation.

Utilities that will study these data should find them helpful in gaging and improving their own operations. Where costs vary widely from averages, or even from the lows, management will want to know the causes. There may be some justification even when costs appear to be greatly out of line, but it would be well to have these justifications in a provable form against the time when some explanation may be required. On the other hand, there will unquestionably be many instances where management will be able to effect economies on the basis of what others can do they can and will do.

However, the best performance, either from the standpoint of operation or of investment, or even the average performance, is not necessarily a yardstick that can be applied against all operations. Local conditions of service, density of population, economic character of community, diversity and kind of load, fuel and water conditions, weather conditions, rainfall and a host of other things must be taken into consideration when making comparisons. Unlike manufacturing companies that may move or expand in other locations, a utility has a fixed locale and may expand only in directions dictated by load.

The data show that the size of operation, for instance,

has a definite effect upon its economy. Small companies have higher investment costs than large ones. It is this benefit from mass operation that gave rise to the great wave of consolidations that began a generation ago, resulting in big systems. Hundreds and hundreds of smaller communities benefited greatly through lower rates and more reliable service. The justification for such consolidations, in spite of the censure that has been heaped upon these big systems, is amply shown in this cost survey.

In the matter of promotion costs one is asked also to look beyond the dollar sign for any yardstick. The annual appliance sales survey which ELECTRICAL WORLD makes each spring shows definitely that customer usage, growth, low rates and revenue per customer are best where most is spent. In that connection, as probably in many others, the unit costs, while valuable to have, are not nearly so important as their relation to the accomplishment. And there again one must take into consideration the many local variants.

It is unfortunate, perhaps, that these unit costs have been spoken of as yardsticks for the reason that, in this industry at least, the term yardstick has in recent years taken on the added connotation of "whip." Of course, these data will be used by regulatory bodies, and should be. But, as with so many other things, the approach can be destructive or constructive. If commissions will see in these data not another means of punishment, but rather an opportunity to encourage the companies under their jurisdiction to improve operations, they will have performed a service that will be reflected in sounder investment, lower rates and a happier industry.

So long as there are different companies, different managements, different cities, different people, different economies, different loads, different weather, different materials, different engineering, different distances, there will be different unit costs. Under such conditions costs can never be the same. Therefore, in applying these data one should hesitate to make raw comparisons without taking into consideration the variants.

Cost data are a powerful medicine. When used with understanding they can be the finest tonic for the maintenance of a strong and healthy operation, but when used otherwise they can be a violent poison.

To Keep or Not to Keep the Sales Force

IF THROUGH force of circumstance load-building programs have to be modified or curtailed, one of the first and most important decisions to be made is the disposition of the sales force. It is not as easy as saying that the force will be reduced to fit the conditions. There are other considerations.

Any decision to reduce the sales force is bound quickly to have an unfavorable effect upon the entire organization, for it will be taken as an admission that there is little or nothing that can be done. It will, in effect, be considered as a declaration that at least so long as the emergency continues the opportunity that comes from growth will be missing. This would not improve morale.

Also, many of the salespeople have been taken out of other departments. If among the first to be let go are members of the sales force, it will be more difficult when the sales force is being rebuilt to get men from other parts of the organization.

There are lots of worth-while things salesmen can do for and with customers besides actually adding load. Load can be salvaged, demands can be changed, dealers can be trained, educational work with architects and builders developed, customers can be shown how better to use their electrical equipment, marketing surveys made.

Even though many of these activities may not be accompanied by a cash register, they can have a very beneficial effect upon employee morale.

Patched Pants Pride

AS DEFENSE PRODUCTION gets into full gear many materials still available in reasonable quantities are going to be difficult, if not impossible, to obtain, even under a well-ordered priority system. There is certain to be more and more resort to substitutes, to improvised methods, even to reversion to methods that were superseded by advances in the art. It is going to tax the ingenuity of designers and operators and maintenance staffs to do the pressing jobs of the moment with relatively unfamiliar materials and assemblies. Men with ingrained notions of "only one way" to accomplish things will find others with more plastic outlooks taking front seats.

Producers of alternative materials will do well to let new markets know about the characteristics and usefulness of their goods for jobs heretofore done by peace-time materials and tools. In many cases they will have to go beyond the mere intrinsic properties of their products by showing how they can be applied by modification of practices in connection with associated devices and materials. We seem definitely headed for an ersatz era and there is no use waiting for a critical stage or impasse to arrive before making a move. We have had plenty of warning—far more than Britain had—and we will have only ourselves to blame if we don't prepare for alternatives while we are shifting production to defense on a wholesale pattern.

Design, construction, operation and maintenance engineers will meanwhile be doing their part in devising substitutes and they have already begun to tell of them in group meetings. It is going to be most helpful to have exchange of ideas and improvisations, particularly where there is more to be proud of than ashamed of in the substitute practice. In fact, the temper of the times is sure to accord credit to those who can find a way to do without customary products and at the same time accomplish a reasonably durable and serviceable job—a sort of patched pants pride.

Washington Comment

By GEORGE E. DOYING, Jr., Washington Correspondent

Faster Production Tempo Adds to Utility Problems

THE U. S. WAR EFFORT is undergoing another sharp change of pace. No longer do the Administration and top policy defense officials talk in terms of a long war. There is now a definite goal—Beat Hitler in two years, by throwing everything the nation has into the battle for more production.

All sights are being reset with that objective in view. It is the "war" effort, not the "defense" effort, now. This means merciless restriction of civilian economy. It means forgetting post-war effects of what is being done today. It means that whatever can be done to increase production or to spread supply for arms making will be done, regardless of what civilian interests are trampled upon in the doing; the order banning scores of uses of copper is an example of spreading a limited supply.

Chance for a Short War

Basic reason for all this is that both the American and British tacticians today see, almost for the first time since the war began, a positive chance to win the war by keeping Russia actively in the field. Returning travelers from Britain have been saying this for several weeks and the Harriman mission's report from Russia has finally sold this idea here. If Russia does fall—Nazi capture of Moscow doesn't mean the end, we're told—another right-about-face over here is inevitable, but Washington isn't thinking about that these days.

The changed tempo is apparent in nearly all high places. Donald M. Nelson, No. 1 man in both SPAB and OPM, has taken to saying that severe restrictions for eighteen months or two years are preferable to a decade of lean times, and you can hear this same tune from a growing number of others—Knudsen, Henderson, Wallace, Batt.

Nelson is cold blooded in his approach to specific problems, as a surgeon in the operating room with a scalpel in his hand. The nation has committed itself to the gigantic task of arming the world, outside the axis territories, against Hitlerism, he argues, and to fulfill those pledges means sacrifices far beyond those for which the nation has so far prepared itself. Significant, too, is the fact that Isador Lubin, now special economic adviser to the President, is handing out to his visitors copies of the Brookings Institution pamphlet "A Short War Through American Industrial Superiority," by Louis Marlio, a Frenchman who once headed the international aluminum cartel.

It is important to note that while talk is current that the New Deal has taken over the war machinery, it is New Dealers like Lubin, Leon Henderson and Vice-President Wallace—New Dealers of a type which might include Nelson himself—who are in the saddle, rather than the Ickes, Cohen variety.

Harder to Get Capacity

All this is going to affect the utilities to a considerable extent, directly and indirectly. Utility schedules for turbo-generator deliveries are going to be squeezed—seriously squeezed, most likely—in 1942. One of the keystones of this telescoping of the war program into a two-year goal calls for maximum acceleration of Navy warship construction.

The Navy already is well ahead of its original schedule in building a two-ocean fleet. In recent weeks Naval procurement officers have gone to all manufacturers with stepped-up schedules for turbine deliveries in 1942. Navy turbine deliveries crowded into 1942 schedules now mean, in almost a horsepower for horsepower ratio, a decrease in the number of utility deliveries which can be made next year. This means, according to OPM Power Coordinator J. A. Krug, that many generators scheduled for installation late next summer or fall in anticipation of 1942 winter peaks will be delayed well into the spring of 1943.

This may mean rationing of electrical energy in many places a year from now, in big industrial centers where utilities have anticipated their load growth and have ordered extra equipment to meet it. Both Nelson and Krug realize this.

To Nelson neither commercial, nor residential, nor non-defense industrial load is "essential" in a literal sense. If the choice lies between adding a generator to meet growing defense and non-defense loads or of diverting either the generator or the manufacturing facilities and scarce materials required to produce it to, say, a Navy order, the answer is plain: The utility generator is delayed and the growth of the war effort power load is supplied by cutting into the consumption of other groups.

FPC's Capacity Plan Is Sunk

Inevitably, where such forced curtailment materializes, utilities will find they are having to take on added industrial load at the expense of more profitable commercial, and perhaps even residential, revenues. This will hit pocketbooks, but it probably can be prevented from becoming a black eye to good will because the rationing will clearly be in spite of prudent company planning.

The Federal Power Commission's five-year plan of geographically programmed power expansion—the plan released last July 16—necessarily goes into the discard under this "big push."

FPC's program was based upon the principle of keeping a maximum amount of manufacturing capacity booked to the hilt and distribution of the output throughout the country in such a way as to keep utilities abreast of both the war load and the normal growth of energy consumption. The two-year war program hasn't room for this "extravagance." It requires, instead, use of the minimum amount of manufacturing facilities and strategic raw materials for construction of new productive facilities so that the maximum amount can be consumed in turning out ships and tanks.

Coordinator Krug already has called upon utilities to halt their promotion and load-building activities.

[*Continued on page 119*]

NEWS OF THE WEEK

Colorado Public Service Meeting Defense Demands

Company rushing $2,500,000 construction program at Valmont steam-electric plant — Will serve new $35,000,000 Denver munitions plant now nearing completion

Scheduled to begin operations this month, the huge munitions plant being rushed to completion about 6 miles west of Denver, Colo., is expected soon to swing into the mighty production line of national defense. Electricity, supplied by Public Service Co. of Colorado, has been available for all requirements at the plant, including about 1,500 kw. for floodlighting during night construction work. An ultimate power and lighting load of approximately 6,800 kw. is anticipated.

Electric service for power and lights will be supplied from the 100-kv. transmission line of the central system of the company to two 10,000-kva, substations on the plant grounds. The central system includes three steam-electric plants and six hydro-electric plants, all interconnected. The generating capacity of this system is in excess of 120,000 kw. A new generator of 25,000 kw. additional capacity is scheduled for installation in this system within the next few months. It is part of the present $2,500,000 construction program which is being pushed to completion at Valmont steam-electric plant and includes, besides the new generator, new boilers, condensers, controls, transformer and substation equipment.

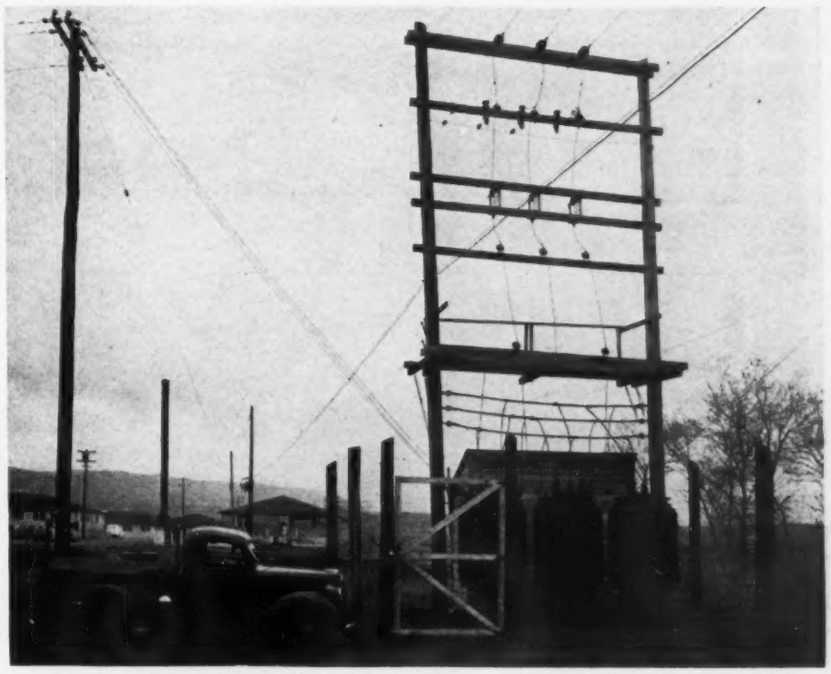
In addition to these preparations, more electric power facilities for national defense and for the growing population needs of the region served by Public Service Co. of Colorado were assured when Guy W. Faller, president and general manager of the company, threw the switch which connected the new 25,000-kva. synchronous condenser to the central system on August 12, 1941. The condenser was installed at the Denver terminal at a cost of one quarter million dollars.

All work at the Denver Ordnance Plant has been rushed from inception. The tempo which has paced the entire project is indicated by the fact that electric service, which required the building of a ¾-mile line over rough country and construction of a new substation, was supplied upon three days notice. Ground was broken in March and in approximately six months hundreds of one- and two-story buildings have sprung up.

Each of the four main manufacturing buildings covers an area of about 400x1,000 ft. About four hundred buildings in all will be built. Total cost of the entire plant is estimated at $35,000,000. The latest type of fluorescent lighting will be used throughout the manufacturing buildings and literally thousands of fluorescent lighting fixtures are being installed.

New Community

The influx of new people to the region has just started. Already hundreds of new dwellings have been built in suburbs west of Denver and adjacent to the Ordnance Plant. One new



TYPICAL SUBSTATION erected by Public Service Co. of Colorado to serve new housing areas around Denver munitions plant

subdivision is called Green Mountain Heights. The buildings are mostly frame, four, five, and six rooms, are quickly built and fairly substantial. A new community of perhaps 25,000 or 30,000 people must be taken care of electrically. These present problems and responsibilities the local company is striving to work out so that all of these new customers will be satisfied customers.

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Krug to Atlanta on Rationing Plan

Electric power rationing in the Southeast, now scheduled to begin November 10, is to be administered by OPM from temporary "on the spot" headquarters in Atlanta. Power Coordinator J. A. Krug will go to Atlanta early next week to take direct personal charge of the operations.

OPM's plan calls for creating a vast power pool into which all generation by every utility involved—public and private alike—will be lumped together and distributed from a hypothetical master switchboard in Atlanta. An experienced load dispatcher will be added to Krug's staff to act as master dispatcher for the pool. He will be assisted by dispatchers from each of the utilities involved.

Power curtailment ordered by OPM Priorities Director Nelson outlines only general categories of consumers to whom energy deliveries are to be reduced. Krug, working with the utilities, will interpret the order in terms of individual customers in advance of effective date. Reason for issuance of the order more than a week in advance is to permit completion of this detail work as a sort of blackboard test run ahead of actual rationing.

It also gives utilities time to cancel some of their contracts carrying ten-day clauses, although Krug feels that this precaution is not necessary where contract non-fulfillment results from a government priorities edict. The Vinson priorities act protects industries against actions resulting from non-fulfillment to meet a government order.

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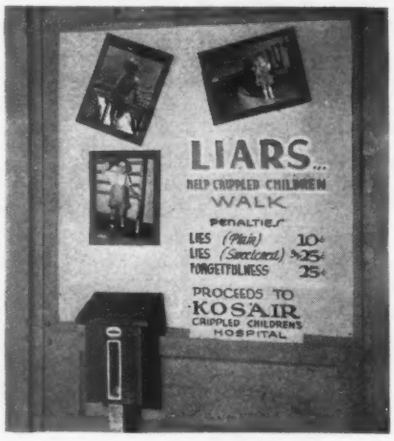
Model Home in Pittsfield

An unusually successful model home, featuring adequate wiring was recently opened for public inspection by D. J. Tierney, a prominent Pittsfield, Mass., realtor. Edward J. Tierney was the building contractor and James Adams the electrician. More than two thousand visitors entered the home on the Sunday afternoon it was opened to the public.

NEWS BRIEFS

UPWARD OF 70 LIGHTING DEALERS are cooperating with New Orleans Public Service, Inc., in the distribution to children of free I.E.S. school book covers. Coupled with the parent's request for covers is a reminder to have a free Light-Conditioning Survey of the home.

HARVEY MORTON, general foreman of construction at Louisville Gas & Electric Co.'s Paddy's Run station, has decided that if his men must tell tall tales, exaggerate, and out and out lie, somebody might as well profit by it. Penalties of 10 cents are imposed for



plain lies, three (sweetened) lies for 25 cents, and 25 cents for forgetfulness. Proceeds go to the Kosair Crippled Children's Hospital. A recent letter from the superintendent of the hospital thanked the Paddy's Run construction group for its $250 donation.

GOOD CUSTOMER RELATIONS is evidenced by many "trouble-shooting" customers in West Penn Power Co. territory. Recently a customer reported a smoking regulator in a substation, another reported a flash seen on a 25-kv. line. A third reported a pole broken in an automobile accident and two women reported a line down and stopped hoodlums from throwing stones at insulators. Customer relations of this type can't be bought; they must be earned.

NAVAL AID AT LYNN—General Electric's River Works recently repaired a 175-kw. generator for a British warship, returning the machine after five days of 24-hour production started at daybreak on a Sunday and including disassembly of a damaged armature, salvaging of its copper coils, retaping, placing and testing conductors, with delivery to the Boston Navy Yard the following Friday. Shop superintendent Frank Brown received the order for the work on a Saturday night, rounded up his force and, by feeding the men on the job, the work was finished a day ahead of schedule. Normally, such a job would require two to three weeks.

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Washer and Ironer Production Cut

Household washing machines and ironers followed refrigerators under compulsory production quotas limiting non-defense uses of scarce materials this week. Priorities Director Nelson, acting upon recommendations of OPM's Civilian Supply Division, ordered the industry to reduce output in the period from August 1, 1941, to December 31, 1941, by 17.3 percent below the average monthly factory sales of the year ended June 30. This is 9 percent under the comparable output in the corresponding period last year.

Estimated demand for washers and ironers to replace those wearing out during the coming year is 750,000 units. Expected production, OPM said, will be considerably more than this figure, leaving a margin for new sales. If currently imposed quotas are continued for a year—more than likely the cut will be increased—OPM estimates that steel consumption will be reduced by 32,000 tons.

Under the order, manufacturers whose average monthly sales in the base period exceeded 12,000 units may produce 50,400 units, or five times 80 percent of the base average in the five-month period covered by the order. Factories which produced between 5,000 and 12,000 units monthly in the base period may produce 22,000 units, or five times 84 percent of their base average. Manufacturers of less than 5,000 units monthly in the base period may turn out 6,000 units, or five times 88 percent of the base output.

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Madison Orders 200,000-Lb. Boiler

Madison Gas & Electric Co. has placed an order for a new 200,000-lb.-per hour Foster Wheeler boiler for addition to its Madison, Wis., plant, J. E. Newton, superintendent of power generation, announced in Madison last week.

The new boiler, which delivers steam at 975 lb. pressure, 825 deg. total temperature is scheduled for shipment in March, 1942, and is expected to be in operation on October 1, 1942.

Two Raymond bowl-type coal pulverizing mills will be installed with the new boiler, it was stated.

Navy's Plans Will Delay Utility Turbine Orders

Advanced delivery dates for Navy turbines expected to cause six-month delay in utility deliveries scheduled for the late summer and early fall of 1942

The Navy is advancing delivery dates all along the line on turbines for the two-ocean fleet. Scores of units originally listed for completion in 1943 have been jammed into 1942 manufacturers' schedules at the inevitable expense of deliveries of utility generating units which are being counted upon to supply next year's peak loads.

The Navy speed-up is part of an over-all drive in Washington to telescope the war effort into a "beat Hitler in two years" production push (see page 72, this issue).

Detailed figures showing just how much additional turbine capacity or how many units are being crowded into 1942 schedules cannot be obtained from the Navy, for military reasons. But in terms both of horsepower capacity and number of units, the figure is large.

Defense Officials Approve

The speed-up is being effected with full approval of defense officials. Power Coordinator J. A. Krug has been informed that considerable manufacturing capacity which has been used to produce utility units is to be taken over to increase the output of facilities for warships. Material shortages, particularly in copper, also are adding to the squeeze.

Result, according to Krug, inevitably will be that many generator units which utilities have ordered for installation late next summer or early fall for year-end peaks will be delayed well into the spring of 1943. Deliveries even then still will be competing with the Navy, as well as the utility orders now on manufacturers' books for early 1943 delivery. It will be Krug's job to decide where those units which can be produced for utilities are needed most. In doing this it is practically certain that some units actually in production will be ordered delivered elsewhere than to the original purchaser.

While the figures disclosing the extent of the Navy speed-up are not available, it is known that during the fiscal year ended last July 1 a total of 1,482 turbines were ordered for warships, and that since then additional orders for five battleships have been placed. Originally, delivery schedules for this equipment were spread over the next three or four years—the time initially planned for building the two-ocean Navy.

The Navy now has building fifteen battleships, which require between 120,000 and 180,000 hp. each. Also under construction are twelve aircraft carriers, rated with 120,000 hp. or more; 54 cruisers, rated with 100,000 hp. or more, and 193 destroyers, requiring about 40,000 hp. each. In terms of kilowatts, this adds up to roughly 12,000,000 kw. to be built for Navy order by the end of 1943 or early 1944. instead of 1946.

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Beloit Expansion Announced by Neff

President Grover C. Neff of Wisconsin Power & Light Co. announced in Madison last week that his company is planning to expand its existing Beloit plant on the Rock River in southern Wisconsin by the addition of two new 20,000-kw. turbines and two boilers. Cost of the project is expected to be about $4,000,000.

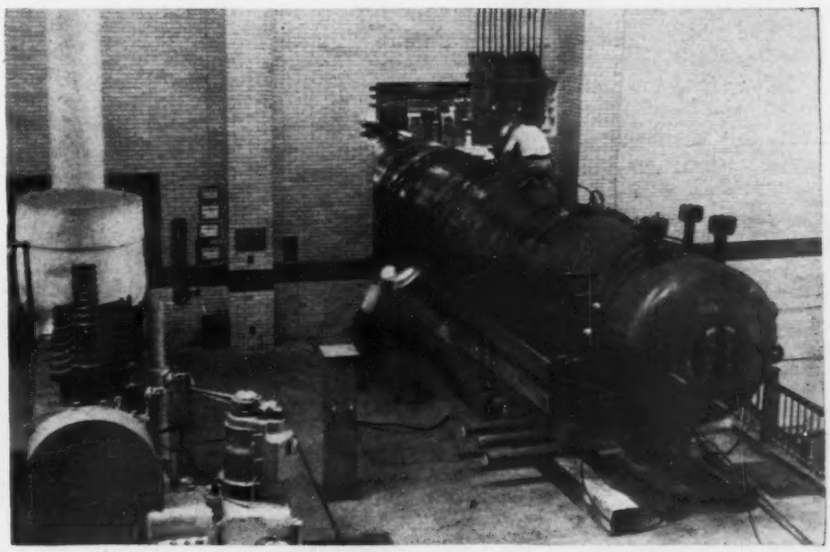
The Wisconsin company recently engaged Sargent & Lundy, Chicago consulting firm, to determine the amount of generating capacity that could be installed at Beloit with the existing supply of circulating water available from the Rock River. On the basis of these studies it was decided to add 40,000 kw. at this point on the system, Mr. Neff stated.

Orders for the equipment have not yet been placed, since studies are continuing with a view to determining the most desirable steam temperature and pressure for the addition. However, it is expected that orders for the equipment will be placed within the next 30 days, Mr. Neff stated.

The decision to add capacity at Beloit—a rapidly expanding defense industry area—was also influenced by the fact that Wisconsin Power & Light Co. has, until now, had no large plants in the southern end of its territory. Beloit is situated on the Wisconsin-Illinois state line. With the addition to the Beloit plant, generating capacity will be pretty well scattered over the entire area served and tied together by high-capacity transmission lines. At present principal generating plants are the Edgewater steam station at Sheboygan on Lake Michigan, in the northeastern portion of the territory, and at Prairie du Sac and Kilbourn hydro plants in the western part of the company territory.

The company's Sheboygan plant is currently being expanded to 60,000 kw. capacity; the expansion is expected to be completed about the first of 1942.

Addition of the 40,000 kw. of generating capacity to the existing 8,500-kw. at Beloit will bring the total system generating capacity of Wisconsin Power & Light Co. to approximately 167,500 kw., Mr. Neff stated.



STEAM DRUM, 30 ft. long, is rolled into Jersey Central Power & Light's Raritan River station through the knocked-out station wall, as part of the utility's $3,128,000 two-step expansion program destined to raise the existing 45,000-kw. station to 103,000 kw. by the end of 1943 ("Electrical World," August 9, 1941, page 78)

Defense Power Demands Engross T & D Committee

Emergency margins in distribution lines and substations, shortages of hardware and poles and simplified practices among topics discussed at Cincinnati meeting

Gearing the power delivery systems of the country to the defense demands of the emergency was the essence of the three-day program of the E.E.I. transmission and distribution committee at Cincinnati last week. Intimate talks by President C. W. Kellogg and Vice-President H. S. Bennion interpreted the Washington factors and set the pattern for papers, reports and discussions which registered the distribution engineers' determination to "find a way to serve commanding loads despite stringencies in material." One slogan suggested was "It can't be done, but we will do it."

Load Shifting

Conversion of industry to munitions production often brings consumption increases of two or 2½ times, but these frequently constitute shifts in substation and line loading without necessitating generation increments, said S. M. Dean (Detroit). A 24-kv. primary system in a thin area is to be changed to 41 kv. wye to meet spot demands; new ceiling values are to be set for cables and transformers. Planning for defense, he said, should be earlier than normal planning so as to offset lag in materials. Substitutions of materials are progressively less promising as shortages multiply.

Distribution systems have margins that can be cultivated for emergencies, said T. G. Hieronymus (Kansas City), if the emphasis is on expediency rather than on conventional design economics. He suggested relaxation of voltage regulation, standard transformers used as boosters, capacitors, higher-temperature loading of cables, flared ends of manholes to accommodate increased cable movement and general resort to salvage measures.

Line Material

Top item of line material shortage is hardware. There will be progressively less zinc to meet the 7,000-ton requirement for 70,000 annual tons of galvanized material for transmission and distribution, asserted E. H. Kendall (Commonwealth & Southern). Substitutions, reductions and eliminations will be imperative; he cited wood pins, braces, guy guards, H-frames and structures. Lead, more plentiful than zinc, appears promising as dip or spray. Four of eleven samples of rust-deterrent paints stood up well on recently analyzed tests. Wade Burleson (Ohio Brass) inferred that zinc might hold out for a year for energized metal use. Ray Waggoner (Hubbard) pleaded for a simplified hardware schedule, saying the 15 per cent of non-standard items among 4,500 listed cause the tie-ups.

Pole timber is in the cedar forests awaiting haulage to rail heads and yard stocks are now at 50 percent due to unfavorable weather in the Northwest, stated Grant Harris (Page & Hill). He urged anticipatory orders to take advantage of shipment opportunities. He mentioned the doubtful rumor of an early banning of domestic creosote; foreign supplies have stopped because there is no time to load in British ports. Ben Hughes reported experiments in splicing poles to offset the shortage of taller ones. E. W. Osterreich (Duquesne) is trying out Douglas fir in the same field.

The transmission and distribution committee is planning to set up a surplus-commodities exchange.

Development of two types of emergency high-voltage cold-setting cable joints was reported by W. F. Davidson for the A.E.I.C. cable engineering section. One is a Cardolite-paraformaldehyde compound by Irvington Varnish and the other an Okonite product, hardening to gel in eleven and 120 minutes, respectively. Both were classed as satisfactory in electrical properties.

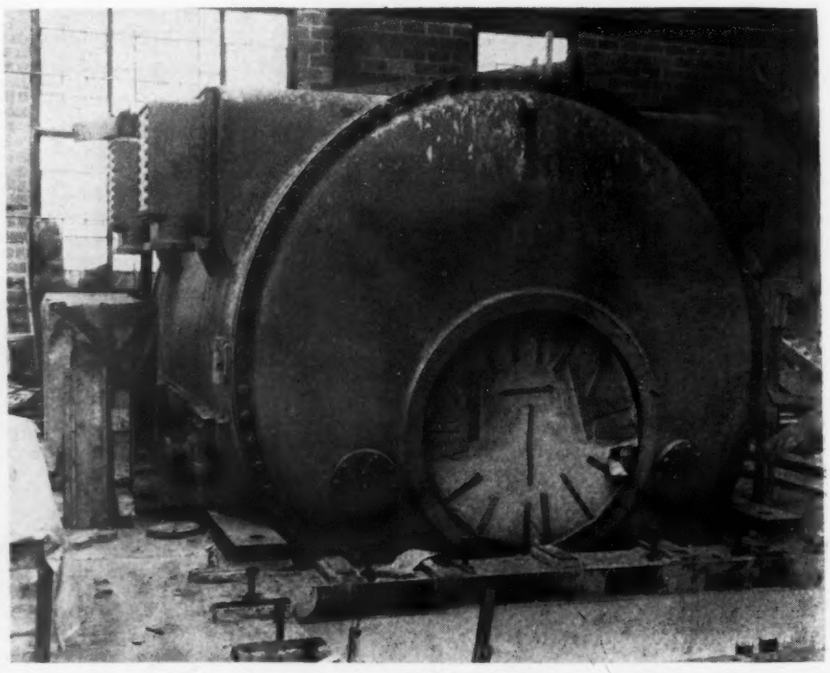
Halving of the number of combinations of conductor size and insulation thickness in PILC solid-type cable was a simplified-practice contribution of the A.E.I.C. committee on power distribution, also conveyed by Davidson. Better deliveries, savings reflected in prices and improved quality are the expected benefits. Comment was largely that the tabulation should not omit a 200-225-mil insulation between the values of 175 and 275. G. B. McCabe (Detroit) will correlate other possible dissents.

Arc-proofing

Development of a new arc-proofing compound called Cablecrete was reported by E. F. Neuzel (Cincinnati). It is resilient, adhesive to lead, easily applied and removed and 80 lb. at $1.50 will cover 15 ft.

A revised classification of six kinds of sheath corrosion and remedial measures was submitted by A. S. Brookes (Newark) and approved for publication.

Consideration of dormant wire-crossing specifications is apparently about to become more active now that Part II of the A.S.A.-approved National Electrical Safety Code is available as handbook H-32 of the Bureau of Standards,



NEW GENERATOR—Stator for new 40,000-kw. Westinghouse hydrogen-cooled, 3,600-r.p.m. generator scheduled to go into service shortly at the Reeves Avenue plant of Virginia Electric & Power at Richmond, Va.

reported A. B. Campbell (E.E.I.). A. E. Davison (Toronto) mentioned a Canadian disposition to effect crossings on joint poles rather than by mid-span crossover.

In lieu of separate conduit specifications, the recommendation of D. M. Bunn that E.E.I. publish the Navy specification (W.C. 581) for guidance of member companies was ratified.

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Three Labor Groups in P. G. & E. Dispute

Strike action against Pacific Gas & Electric Co. in its East Bay division by outside workers who are members of the CIO Utility Workers Organizing Committee is being held in abeyance pending the outcome of hearings which will begin November 3, before the San Francisco regional director of the National Labor Relations Board. In dispute is a demand from this group that it be recognized as bargaining agent for division employees. At the same time the NLRB will hear charges by the AFL International Brotherhood of Electrical Workers that P. G. & E. has engaged in unfair practices and has fostered a "company" union.

"What is involved here is a jurisdictional fight between three different labor organizations," said P. M. Downing, P. G. & E. vice-president and general manager, in commenting on the dispute. "Each wants to be the exclusive bargaining representative for the employees. This controversy has been going on for four years. It began in 1937 with the Labor Board, acting on a petition filed by the CIO, designated all physical workers on the system below the rank of job foreman as the appropriate unit for collective bargaining purposes.

"The NLRB held an election to determine which organization these employees desired should represent them. This election resulted in a large majority for the California Gas and Electric Employees Union, an independent organization. On complaint by the CIO that the company had interfered with the free choice of the employees, the Labor Board refused to certify the successful organization. . .

"The CIO recently filed an amended petition asking that the bargaining unit be limited to the outside employees in Alameda and Contra Costa counties. Without waiting for the board to hold a hearing on this petition the CIO now demands that the company recognize it as the sole bargaining agent in this area."

Supposition is that the petitions filed by both CIO and AFL unions are aimed at the calling of another election.

Henderson Plans Lower Prices for Copper Wire

Manufacturers to be asked to freeze prices, pending development of "fair" price schedules — Tentative schedules materially under present quotations

Steps are being prepared in Washington defense agencies to force down the price of copper wire. Manufacturers will be given an opportunity to reduce prices voluntarily, but the present temper of the Office of Price Administration is to impose a ceiling below current market levels if necessary.

First move will be an invitation from OPA to wire manufacturers for a conference in Washington, probably within the next week or two. The invitation likely will be accompanied by a request from Administrator Henderson that manufacturers "freeze" existing prices until the broader subject of what "fair" price schedules should be can be worked out.

Prices Lowered

OPA is now preparing its idea of what wire schedules should be. While not finished, these are known to be materially under present quotations, which OPA says are 20 to 30 percent higher than a year ago.

These schedules will be ready for the meeting with industry representatives. They will be laid on the table and manufacturers given a chance to argue against them.

Unofficial reactions from the manufacturers received here are that efforts will be made to justify recent increased quotations on the ground that, while copper prices have not advanced above the "voluntary" 12-cent ceiling, costs of other materials necessary for wire manufacture have gone up. Insulated wire, at least, requires considerable quantities of cotton, chemical ingredients, yarns, rubber, tin, etc., most of which are sharply higher in price.

The copper wire price steps are part of an all-inclusive price "stabilization" program being started by OPA in the multitude of fields using copper. The program was initiated on the heels of the drastic copper use curtailment order issued last week by Priorities Director Donald M. Nelson. The program will bring under scrutiny prices at both the manufacturing and distribution levels.

First concrete action in this field is expected to be a price "ceiling" schedule for all building hardware. This schedule will establish presently prevailing quotations at top prices until studies can be completed looking toward reducing the charges for these items. Field investigations already are under way into prices on non-ferrous foundry products and expectation is that a "ceiling" below current levels will be imposed until manufacturers reduce prices voluntarily.

Administrator Henderson also has indicated his office will look into prices of consumers' goods using copper to determine whether price increases are being traced back to copper shortages. Included in this category of products will be generators, motors, transformers, as well as radios, ranges and cooking utensils.

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Power Club Talks Defense Contracts

Distribution of sub-contracts on defense work from the standpoint of the prime contractor and the sub-contractor was the theme of the first fall meeting of the Interstate Power Club, held this week in New York.

R. E. Gillmor, president Sperry Gyroscope Co., expressed the position of the prime contractor and leading discussions of the sub-contracting side were representatives of State chambers of commerce in New Jersey and New York and T. S. Chadeayne of R. Hoe & Co.

Francis McQuillen, West Penn Power Co., suggested that utility customers needing defense business should call at the office of the Division of Contract Distribution, also at local Army and Navy Procurement offices and obtain check lists of orders available daily. Further suggestions of Mr. McQuillen included soliciting prime contractors for sub-contracts, advertising for sub-contracts, contacting State chambers of commerce, filling out plant survey forms, writing for booklets "How to Sell the Navy" and Army Purchase Information Bulletin and attending local product exhibits and defense production clinics.

The following officers were elected and appointed: Chairman, Robert G. Ely, Public Service Electric & Gas Co. Directors, J. H. Coates, Ebasco Services, Inc.; J. C. Murtha, Consolidated Edison Co. of New York; L. G. Marshall, Jersey Central Power & Light Co.; John T. West, Pennsylvania Power & Light Co.; W. A. F. Pyle, Delaware Power & Light Co. Secretary, W. J. Roth, Public Service Electric & Gas Co.

Structural Steel Shapes Simplified

OPM has requested the steel industry to reduce sharply the number of sizes of structural steel beams, channels and angles. The simplified list of sizes is scheduled to go into effect February 1, 1942.

Purpose of the move is to avoid tieing up mills with small orders for odd-sized rollings. The simplified schedule, recommended by A. D. Whiteside, chief of OPM's iron and steel section, was drawn up after consultation with the Army, Navy, Maritime Commission and other defense agency officials, as well as with architects, engineers and designers. The number of angle shapes is reduced 50 per cent in the recommendations, and beams, channels and other shapes almost as much. All shapes regularly used in ship, car and building construction are retained, however.

A complete list of shapes recommended for continued production may be obtained from the iron and steel section.

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Wisconsin Electric Group Elects New Officers

Officers of the electric section, Wisconsin Utilities Association, for the coming year were elected at the closing session of the annual section convention held recently in Milwaukee.

Paul De Leon, commercial manager Wisconsin Power & Light Co., Madison, was elected chairman of the commercial division, and J. H. Dunham, promotional supervisor Wisconsin Gas & Electric Co., Racine, vice-chairman. J. A. Tyvand, chief engineer Wisconsin Gas & Electric Co., Racine, was named chairman of the technical division, with V. A. Thiemann, Wisconsin Public Service Co., Green Bay, vice-chairman.

•

Utilities Sign Pact for Power Interchange

An agreement for the interchange of power has been signed by the Arkansas Power & Light Co. and the Empire District Electric Co. of Missouri. The interchange will be effected through a $500,000 transmission line to be built immediately by the Arkansas Power & Light Co. The line, to be operated at 154,000 volts, will be extended from the Arkansas Power & Light Co.'s substation at Norfolk, in north Arkansas, to the Ozark Beach hydro-electric plant of the Empire District Electric in south Missouri.

Arkansas Corporation Commission recently granted authority to the Arkansas utility to construct the line provided the interchange agreement could be signed.

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Gas Industry Sees Competition Ahead

Flexible rate programs and preparation for future competition were recommended at the twenty-third annual meeting of the American Gas Association last week by H. Carl Wolf, president of the Atlanta Gas Light Co.

"Today we have a sellers' market," Mr. Wolf pointed out, "and if we had only the present to consider it would be simple to disband our sales forces, cut out advertising and discontinue all promotional activities. Our promotional policies of the next few years must be planned for post-war days."

Consolidated Edison Co. of New York, largest single operating utility system in the American Gas Association, has withdrawn from active participation in the association. The move, it was said, resulted from recent activities of S.E.C. which might result in the requirement that the association be registered under provisions of the Holding Company Act.

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Will Rebuild Lines

Work is to begin immediately on rebuilding all the lines of the Arkansas-Missouri Power Co. in Walnut Ridge and Hoxie, Ark. The project will cost $25,000.

MEETINGS

Pacific Coast Electrical Association—First fall joint meeting, Fresno, Calif., November 6-7.

International Association of Electrical Leagues—Sixth annual conference, Raleigh Hotel, Washington, D. C., November 12-14. O. C. Small, secretary, 155 East 44th St., New York, N. Y.

American Society of Agricultural Engineers—Fall meeting, Stevens Hotel, Chicago, Ill., December 1-3. Raymond Olney, secretary, St. Joseph, Mich.

Exposition of Chemical Industries—Grand Central Palace, New York, N. Y., December 1-6.

American Institute of Electrical Engineers—Southern district, St. Charles Hotel, New Orleans, La., December 3-5; winter convention, New York, N. Y., January 26-30. H. H. Henline, national secretary, 29 West 39th St., New York, N. Y.

National Association of Manufacturers—Congress of American Industry, Waldorf Astoria Hotel, New York, N. Y., December 1-5.

Petroleum Electric Power Association—Annual conference, Baker Hotel, Dallas, Tex., December 4-5. K. K. Kreamer, Petroleum Electric Power Association, Houston, Tex.

American Society of Heating and Ventilating Engineers—Annual meeting, Philadelphia, Pa., January 26-30. A. V. Hutchinson, secretary, 51 Madison Av., New York.

International Heating & Ventilating Exposition—Biennial exposition, Commercial Museum, Philadelphia, Pa., January 26-30.

Power Pool Planned for Oklahoma Plant

Terms of a unique contract proposed for temporary power supply to an aluminum plant to be built in Arkansas were disclosed by R. K. Lane, president Public Service Company of Oklahoma, at the two-day conference last week of the electric division of the Oklahoma Utilities Association.

Under the terms of this proposed contract sixteen utilities serving the area from Kansas City to New Orleans will furnish some 65,000 kw. to Arkansas Power & Light to serve this new aluminum plant being built by the Defense Plant Corporation at Camden, Ark., until the plant receives its own generating equipment (three 35,000-kw. units). The plant is expected to be in operation by April. Under this contract the sixteen companies will furnish all the power they can up to 65,000 kw., but without guarantee. The pool will be managed by an operating committee.

Three Types

Participating companies will be of three types: Limited (generating), transmission and principal, the essential difference being that the principal participants will receive incremental generating cost plus one-quarter mill per kilowatt-hour and the others a plus of three-quarters of a mill—the principals to share in any profit or loss. Arkansas Power will serve the load at its regular industrial rates. Out of the pool revenue will come write-offs of needed new construction at the rate of 2½ percent per month, but not to exceed 40 percent.

By this pooling of utility resources in neighboring states the aluminum plant will be able to get under way a year or more before it receives its own generating equipment.

Three of the speakers, J. C. Happenny, chairman of the division; General George A. Davis, executive vice-president of Oklahoma Gas & Electric, and S. B. Williams, editor ELECTRICAL WORLD, emphasized the need for telling the utility story to the public to meet the expanding government power operations.

As an answer to the problem of load building under present conditions a paper by A. A. Brown, Oklahoma Gas & Electric Co., suggested selective selling of loads that do not have much if any peak responsibility.

Fluorescent lighting problems were outlined by B. E. Lowe, Southwestern Light & Power, and D. J. Frandsen, Oklahoma Public Service. Walter Sturrock, General Electric Lamp, told the meeting of the laboratory work behind the development of new light sources.

Partial Recovery of Last Week's Loss

The amount of electrical energy distributed by the electric light and power industry for the week ended Saturday, October 25, was 3,299,120,000 kw.-hr., according to the Edison Electric Institute, marking a partial recovery from the losses incurred through the Columbus Day holiday a week ago last Monday.

At that time output dropped approximately 40,000,000 kw.-hr. due to the loss of a full day's output in the industrial classification on account of the holiday. The recovery is only partial, amounting to 26,000,000 kw.-hr.

For the nation increase of 15.1 percent is close to last week's increase of 15.3 percent. Likewise, most of the divisions continued to increase output at the same rate as obtained last week, New England showing the only substantial increase.

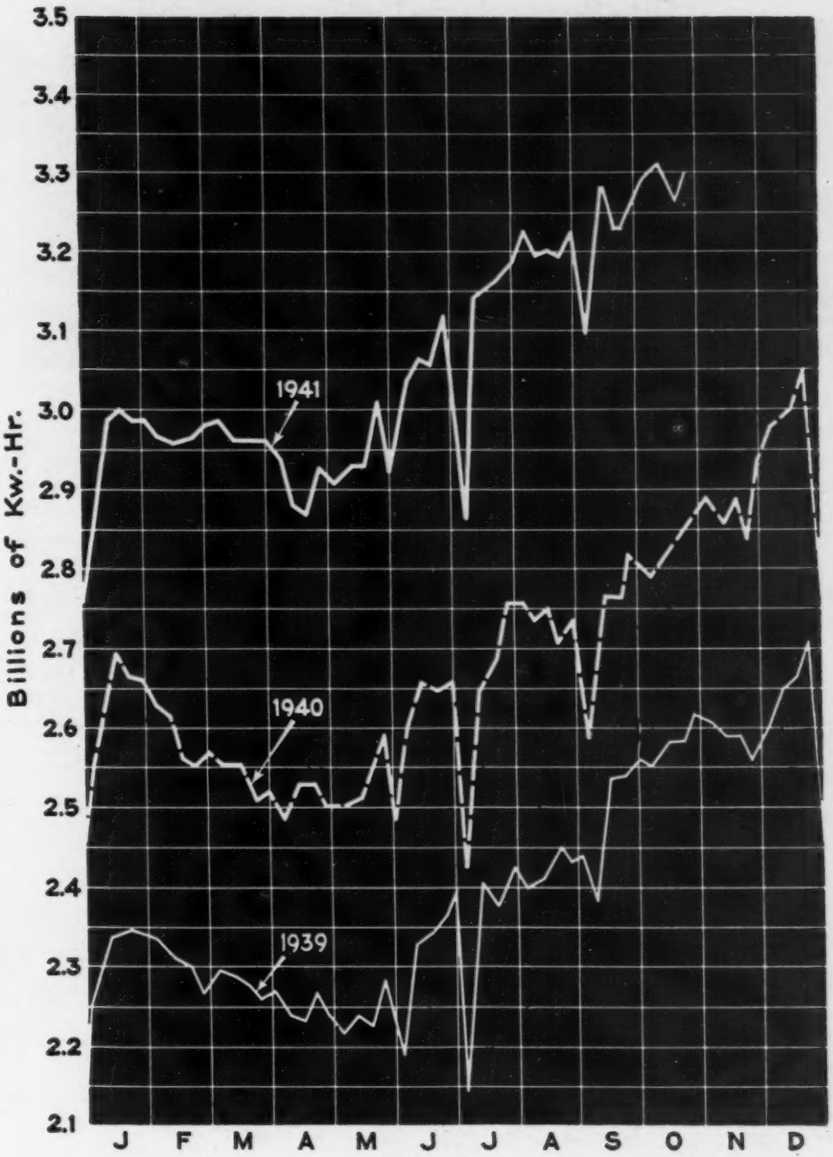
Weekly Output, Millions Kw.-Hr.

1941		1940		1939	
Oct. 25	3,299	Oct. 26	2,867	Oct. 28	2,622
Oct. 18	3,273	Oct. 19	2,838	Oct. 21	2,576
Oct. 11	3,315	Oct. 12	2,817	Oct. 14	2,583
Oct. 4	3,290	Oct. 5	2,792	Oct. 7	2,554
Sept. 27	3,233	Sept. 28	2,816	Sept. 30	2,558
Sept. 20	3,232	Sept. 21	2,769	Sept. 23	2,538

Percent Change from Previous Year

	Week Ending		
	Oct. 25	Oct. 18	Oct. 11
New England	+17.5	+14.0	+20.7
Mid-Atlantic	+12.2	+12.6	+16.3
Central Industrial	+17.4	+17.8	+19.6
West Central	+16.5	+17.5	+15.7
Southern States	+17.9	+17.0	+19.3
Rocky Mountain	+11.9	+18.4	+20.3
Pacific Coast	*+ 8.4	*+ 9.3	*+10.6
Total United States	+15.1	+15.3	*+17.7

* Percentage should be higher — data under revision.



TVA to Build New Line

Tennessee Valley Authority has announced that construction of a 24-mile, $225,000 power transmission line between Guntersville Dam and Huntsville, Ala., would begin immediately. F. F. Beauchamp, TVA Alabama division manager, said the new 154,000-volt line would replace a 110,000-volt line. In addition, Mr. Beauchamp said a second transformer would be built at the dam at a cost of about $180,000.

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Primary Load Up

Hydro-Electric Power Commission of Ontario reports primary load for all systems in September at 1,983,729 hp., against 1,732,799 hp. in September, 1940, an increase of 14.5 percent. Primary and secondary loads for all systems totaled 2,149,138 hp., compared with 1,928,161 hp. in September, 1940, an increase of 11.5 percent.

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Coal Used in September

Electric utility power plants consumed 5,848,140 tons of coal in September, the Federal Power Commission has reported. Of the total, 5,595,645 tons were bituminous coal, a decrease of 0.8 percent under August consumption, and 252,495 tons were anthracite, a decrease of 12.8 percent under August consumption. Total stock of coal on hand at electric utility power plants on October 1 was 12,954,117 tons. This represents a 5.6 percent increase over the stock on hand September 1, 1941, and 3.4 percent increase compared to the stock on hand October 1, 1940.

Start Work on New Plant

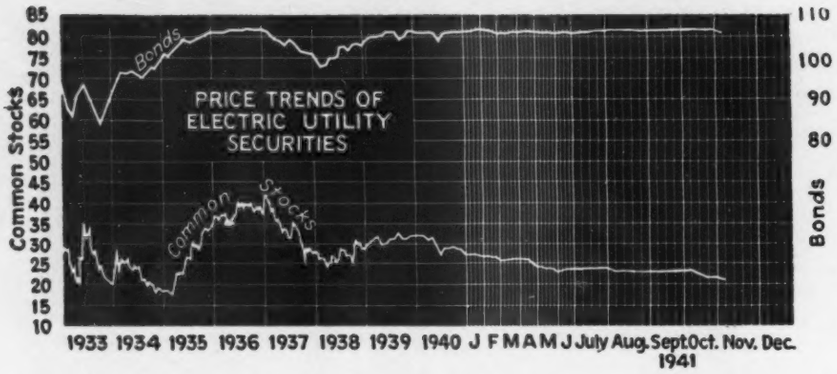
Mississippi Power Co. will begin construction immediately on the large steam-propelled electric generating plant to be erected at Hattiesburg, L. P. Sweatt, Jr., vice-president and general manager, has announced. Successful conclusion of a special financing program has provided the company with cash funds, Mr. Sweatt said, adding that some $2,800,000 would be spent for extensive additions to the system.

•

Unit to Cost $142,000

Wisconsin Public Service Commission has authorized the Wisconsin Hydro-Electric Co. to build a 1,200-kw. Diesel generating unit at Clear Lake, Polk County, at a cost of approximately $142,000.

Utility Stocks Lose Ground; Bonds Firm


PRICE TRENDS OF ELECTRIC UTILITY SECURITIES
Bonds
Common Stocks
Common Stocks
Bonds
85 80 75 70 65 60 55 50 45 40 35 30 25 20 15 10
110 100 90 80
1933 1934 1935 1936 1937 1938 1939 1940 J F M A M J July Aug. Sept Oct. Nov. Dec. 1941

Electric light and power stock prices continued during the past week the downward trend which has existed in October—"Electrical World" index, 22.1; last week, 22.5; last year, 29.0. Bonds remained unchanged at 105.7; last year, 105.9

Kentucky Stock Sale Approved by SEC

The Securities and Exchange Commission has exempted the proposed 150,000-share common stock issue of Louisville Gas & Electric Co. from provisions of its competitive bidding rule, the first transaction of this nature since the rule was instituted.

The company proposed that the shares be sold locally through five company employees at $23.50 per share, and is the first application on the part of a large utility company for permission to market its own securities. Representatives of New York and Louisville financial houses appeared before the commission asking that SEC force the company to sell the securities through competitive bidding. In the arrangements approved by SEC the company has offered Louisville dealers a concession of 75 cents per share.

The commission found "no appropriate basis for disapproving" the company's desire to avoid payment of underwriting fees and that plans to market the issue locally were in line with the objectives of the act.

It is expected that if the sale of stock is successful Standard Gas & Electric may offer to the public the remainder of the common stock, held by Louisville Gas & Electric Co. of Delaware, and this in turn could be a step in the liquidation of the Delaware sub-holding company.

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Derby Gas Plan Ratified At Special Meeting

Plan of corporate simplification and recapitalization of the Derby Gas & Electric Corp., Derby, Conn., as amended, and as approved by the Securities and Exchange Commission, has been ratified by stockholders in a special meeting at Wilmington, Del. More than 80 percent of the publicly held preferred stock was represented at the meeting in addition to the preferred and common stock held by the Ogden Corp., parent concern.

Under the plan holders of Derby Gas $7 and $6.50 preferred stocks will receive in exchange for each share three shares of new common stock. Ogden Corp. will surrender $2,250,000 of a $5,000,000 claim against Derby Gas, and will receive under the recapitalization 62½ per cent of the new common stock.

•

Propose to Simplify Kentucky Utilities

As a step in the liquidation of United Public Service Corp., a Middle West Corp. affiliate, the Kentucky Utilities Co. of Lexington, Ky., has filed an application with the Securities and Exchange Commission to acquire all the assets of Kentucky Power & Light Co., serving Maysville, Ky.

Under purchase contracts, Kentucky Utilities would acquire from United Public Service Co. a $1,200,000 principal amount promissory note and 16,000 shares of Kentucky Power & Light common stock for $1,100,000.

After purchase of the note and shares, Kentucky Utilities will hold all of the outstanding stock of Kentucky Power & Light and $1,207,400 principal amount of first mortgage bonds will be retired.

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Utility Reports

	Net Income 1941	1940
*Detroit Edison and subs.	$12,329,340	$10,386,648
†Calif. Electric Power	636,951	383,642
†El Paso Electric	670,450	470,130
†Key West Electric	73,625	41,910
†Mountain States Power	697,806	735,007
†Oklahoma Gas & Electric	2,852,184	2,688,153
†San Diego Gas & Electric	1,831,352	1,740,537
†Southern Colorado Power	279,924	217,297
†Superior Water, Lt. & Pwr.	100,847	111,469
†Western Public Service and subs.	70,063	48,742
†Puget Sound Power & Light and subs.	2,204,868	2,048,582

*Twelve months ended September 30.
†Twelve months ended August 31.

Permits Purchase of Utility Units

Federal Power Commission has authorized the Otter Tail Power Co. of Fergus Falls, Minn., and operating in Minnesota, North Dakota and South Dakota, to acquire certain electric facilities of Minnesota Utilities Co., Minneapolis, Minn.; to issue $200,000 principal amount of first mortgage bonds, 3 percent series of 1971, and to borrow not more than $850,000 from a bank.

Approval of the acquisition followed a finding that the proposed merger of properties "will tend to advance the co-ordination in the public interest of facilities subject to the jurisdiction of the commission and will be consistent with the public interest."

According to the application, the two groups of properties authorized to be acquired by Otter Tail are less than a third of the total holdings of Minnesota Utilities Co. Properties in the Twin Valley district are located in Mornam, Mahnomen, Clay, Becker and Polk Counties, Minn., and properties in the Wheaton group are located in Traverse, Doughlass, Otter Tail, Swift, Chippewa, Big Stone, Lac Qui Parle and Wilkin counties, Minn.

•

Machine Builders Issue Electrical Standards

National Machine Tool Builders' Association has issued its newly adopted "Machine Tool Electrical Standards" for power-driven, complete metal working machines not portable by hand. Purpose of the specifications, it was said, is twofold—to relieve customers of the necessity of writing elaborate electrical specifications of their own, and to insure that machine tools will be properly wired.

If the standards meet with general acceptance the association expects to handle the application of motors and control on a production basis and, it was declared, without the delay, expense and confusion which result from attempts to follow special instructions.

YOU CAN PUT THOSE NEW MACHINES RIGHT TOWORK. ALLWE DO IS TAKE OUT THIS 100-AMP BREAKER AND PLUG IN A 225. THE CABLES ARE OK
I GUESS YOU WEREN'T KID-DING WHEN YOU SAID YOU'D TAKE CARE OF THE POWER IN THREE MINUTES

Keep Up with Shifting Loads with This New Removable Breaker

WHEN plant loads grow rapidly and shift quickly—as they do today—your breaker capacity must keep in step. If it lags behind, shutdowns and loss of valuable production time soon catch up with you! That's another reason why we built this *removable* breaker, which permits interchanging different-rated breaker units—in *less than three minutes*—to meet new load conditions.

This new breaker is equally easy to install, operate, and inspect. Because of its unique flexibility and its ability to quickly restore service after protective interruptions, it saves valuable minutes of production time daily. It protects against the damage and prolonged delays often caused when less adequate protective devices are subjected to severe short-circuits.

Install these new AE-1 breakers in your lighting, power, and motor circuits—up to 600 volts. A new booklet (GEA-3600) tells how and shows where to use them. For a copy, write the G-E office near you, or address General Electric Co., Schenectady, New York.

THE BREAKER WITH THE DISCONNECT FEATURE

GENERAL ELECTRIC

660-23-7500

OPERATING PRACTICES

Plastic Pole Tags Replace Aluminum

In the search for an acceptable substitute for aluminum pole tags, which are no longer available, Philadelphia Electric Co. has been experimenting with plastic identification tags.

The new tags are made of a white

PLASTIC pole tags, same size, shape and approximate cost as no longer available aluminum identifications, promise to be excellent substitute

cellulose acetate, with markings printed in black, over which a thin glossy coating is laminated for weatherproofing purposes. They are the exact size and design of the aluminum tags the utility formerly used and the cost is about the same.

Under amateur testing, the tags have proved pliable, acid-proof, nonflammable, highly resistant to cutting and cracking, and have excellent readability. One tag has been under severe test since August 4 in the paint shop laboratory. Weather conditions are being produced by regulated exposure to heat, cold and water; the tests, of course, have not extended sufficiently to serve as a basis for an opinion on the value of the tags in the field.

An initial order of 2,000 tags has been manufactured for the utility by Williams & Marcus Co. of Philadelphia.

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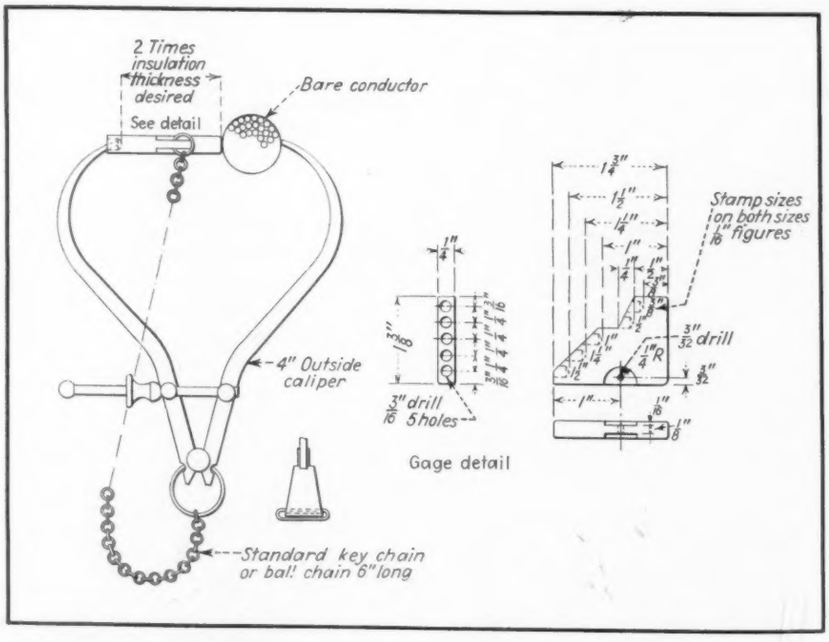
Gage Sets Caliper to Insulation Thickness

A simple aluminum block gage (shown) is used by Detroit Edison Company cable splicers for setting calipers used to gage the thickness of insulation being applied to underground cable conductors. Value of the gage lies in the fact that it permits a splicer to set his calipers for the insulation thickness he desires, when he starts taping the conductor, and use the calipers throughout the taping operation without changing the caliper setting and without use of a scale.

At the start of taping operations the splicer slips one point of the caliper into a hole in the gage block corresponding to the thickness of insulation he wishes to apply to the bare conductor. Distance from the bottom of this hole to the face of the gage block is two times the radial thickness of the insulation to be applied to the conductor. With the block in place the caliper is slipped over the bare conductor and adjusted so that the distance between face of the block and the free caliper point is equal to the diameter of the conductor. Then, when the block gage is removed, the distance between caliper points corresponds to diameter of finished taping when correct thickness insulation is applied.

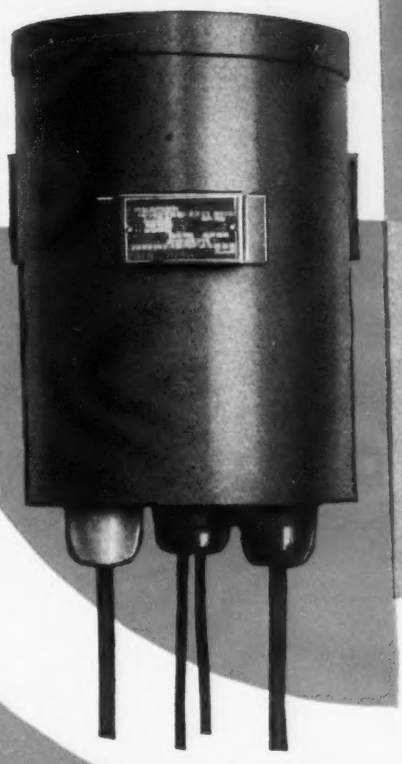
Without the block gage caliper points would have to be set to the bare conductor, diameter read on a scale, the insulation thickness added



CALIPER and gage details

ANNOUNCING A NEW OUTDOOR POTENTIAL TRANSFORMER.

The JE-3



TYPE JE-3

For outdoor metering applications
2300 volts and below

INSULATION

230, 460, and 575 volts—full-wave, 50 kv;
2300 volts—full-wave, 60 kv

ACCURACY

¼W, ¼X, ½Y

NOW, G. E. OFFERS... A complete line of outdoor current and potential transformers, 15 kv and below, which conform to ASA insulation standards

These new standards, which are met by this now complete line of transformers, provide a means whereby all apparatus on a line can be co-ordinated to have the same insulation strength. This facilitates the selection of adequate protective equipment.

All these transformers meet or exceed the highest accuracy standards and can be obtained in a wide variety of mechanical constructions to meet every installation need.

Ask your G-E office for a copy of our new bulletin, GEA-3650, which covers both outdoor current and potential transformers, 15 kv and below. Or write General Electric, Schenectady, N. Y.

GENERAL ELECTRIC

604-6-6400

to this value, and the caliper set by scale to the value.

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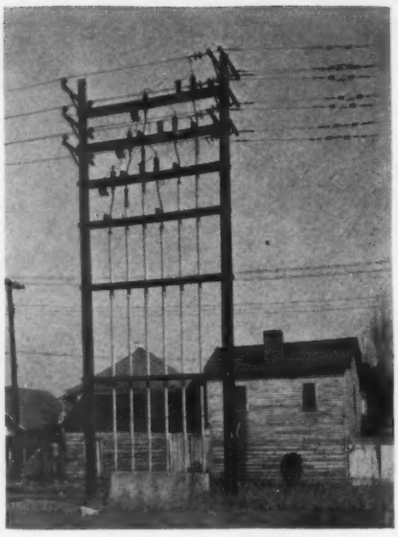
Riser Structure Carries Six Phases

Several riser structures each consisting of two wood poles and five double wood cross-members for conduit and cable supports are used by the Memphis (Tenn.) Light, Gas and Water Division on its distribution system. A typical 23-kv. riser structure is located 2,100 ft. from the Willett Street substation.

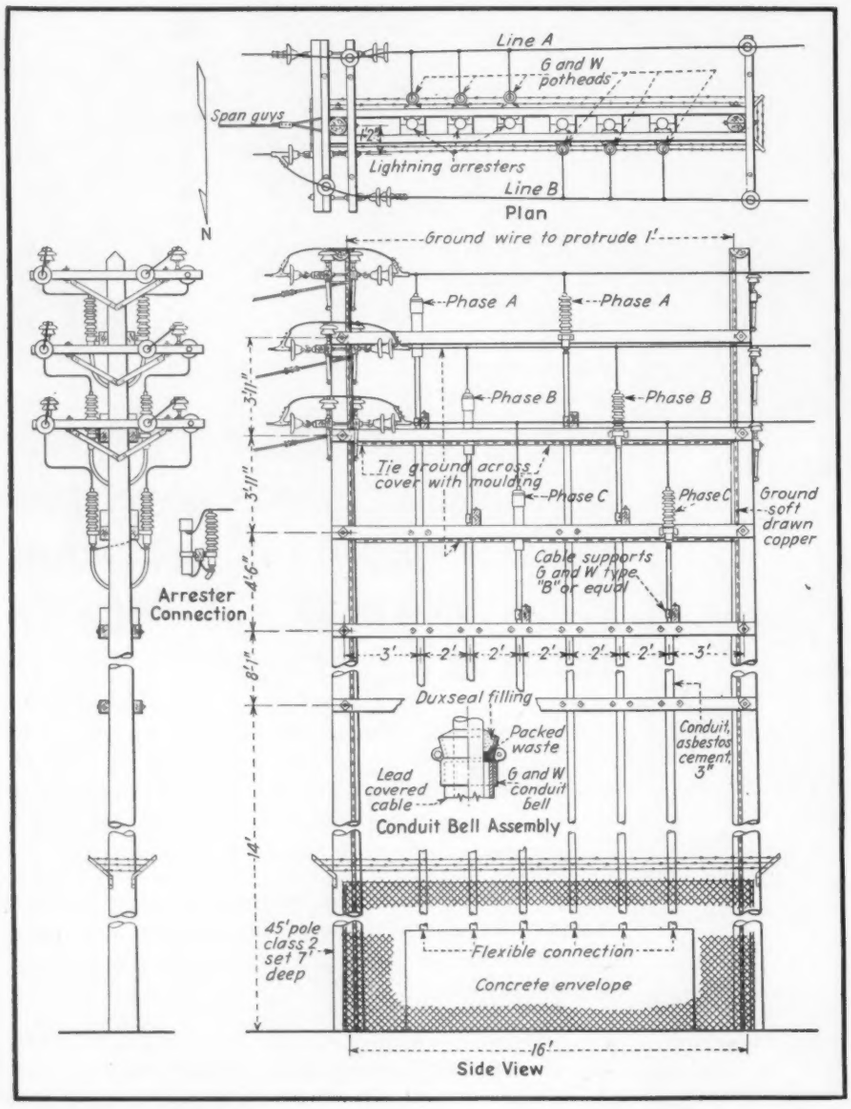
Two 23-kv. tie circuits are run in separate 27-kv., three-conductor, type H cables underground in duct line from the substation to the last manhole, where a trifurcated splice is installed. Here the conductors in the underground cables are fanned, and extended by six single-conductor cables to the overhead conductors.



RISER structure serves two 23-kv. tie circuits

The riser structure is made up of two 45-ft., class 2 poles, set 7 ft. deep and on 16-ft. centers, and ten creosoted 4 x 6-in. x 17-ft. planks serving as cross-members. Two planks on opposite sides of poles form a cross-member.

Each of the six-phase conductors is run from the last manhole through the concrete envelope with 3-in. asbestos cement conduit placed between sections of the cross-members. The risers emerging from the conduit are fastened by cable supports to 4 x 8 x 17-in. creosoted planks mounted on the cross-members. Connection between cables and overhead conductors is made through individual potheads. A 13,800/23,000-volt lightning arrester is connected to each riser conductor. A ground wire protrudes 1 ft. above each pole top, and a tie to each ground wire and lightning arrester is made on the three upper cross-members.



OUTLINE of 23-kv. riser structure

Current-Loading of Ground Connection—II

By J. R. EATON *
Purdue University, Lafayette, Ind.

In the case of high currents of short duration flowing through a ground connection no appreciable amount of heat can be dissipated by the normal process of thermal conductivity. The rise in temperature of the soil adjacent to the surface of the electrodes may be determined by the following relation:

$$\theta = \frac{0.24i^2}{\delta\sigma}\rho t$$

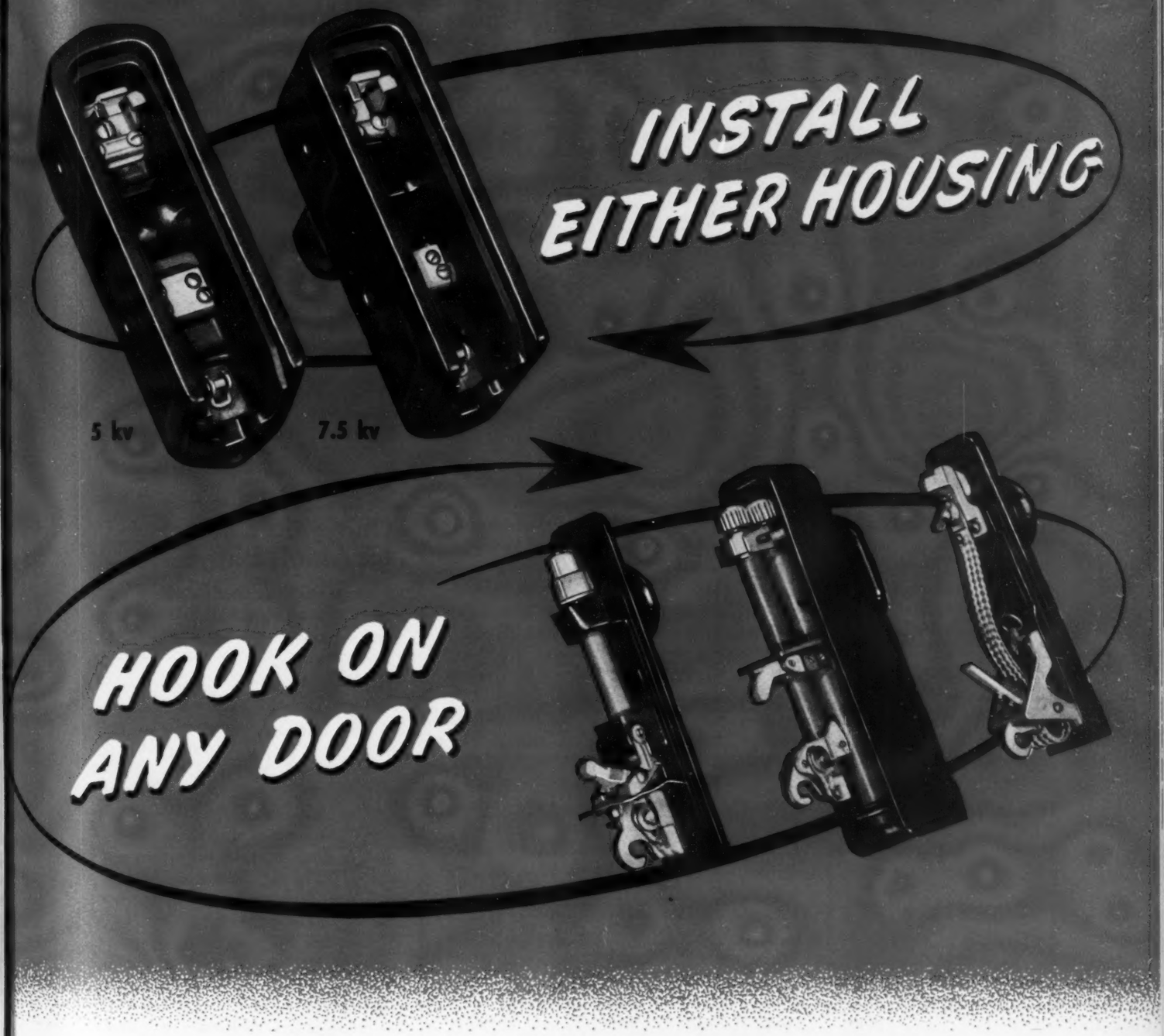
where θ equals the temperature rise, i is the current density at the electrode surface, ρ is the soil resistivity, δ is density of the soil, σ is the specific heat and t is the time, all in c.g.s. units.

From this relation it may be seen that for a given electrode shape and dimension the permissible current density for a given temperature rise is inversely proportional to the square root of the soil resistivity. Hence, an electrode arrangement of given surface area may be satisfactory in one locality where the soil resistivity is low, but be quite inadequate in another locality where the soil resistivity is high.

Currents of high magnitude but of short duration are frequently imposed

*Consultant for James G. Biddle Co.

FOR 80% OF YOUR CUTOUT REQUIREMENTS



WHEN you clamp any G-E indicating cutout on a crossarm you practically install *three different cutouts!* Because you can use one of three different doors to get any cutout you want—single-element, reclosing, or disconnect. That's G-E flexibility: two housings and three doors, in the 50-ampere rating, to fill 80 per cent of distribution fuse cutout requirements.

Take the old standby, the single-element door. The complete indicating and drop-out mechanism is right in the door. Hook it on either standard housing—it's ready for service.

Same with the recloser—everything's in the door. It closes the line one second after the first fuse link blows, and *it can pay for itself the first time it operates.*

The disconnect door, too, is complete in itself. It's the new flexible-blade type, with indicating and isolating features, with all contacts housed.

Look over this five-part cutout combination. It's the stock-reducing, money-saving answer to 80 per cent of all distribution cutout problems. Two housings—three doors. You can't beat it. And there's a similar 100-ampere line to take care of the other 20 per cent.

Write for Bulletin GEA-3448. Address General Electric, Schenectady, New York

GENERAL ELECTRIC

406-5-5254

on the ground connections of stations having wye-connected transformer banks during periods of line-to-ground faults which are cleared promptly by breaker action. Dry-out of the ground surrounding the electrodes depends of course on the number of faults which occur in quick succession before stable conditions in the ground are re-established. It is obvious that the calculation of the ground performance is highly complicated as well as probably unsatisfactory. However, if consideration is given to the number of watt-seconds which must be dissipated by the ground connection it may be possible to estimate the amount of moisture which could be evaporated by this process.

Currents of high magnitude and long durations are perhaps relatively infrequent, but sometimes occur at neutral points as the result of ground faults which are not cleared promptly by circuit breaker action. The grounds on ground fault neutralizers are sometimes required to carry current over a considerable period of time as systems of this type are usually not relayed promptly for line-to-ground faults. In some instances neutral points on distribution transformers may be required to carry considerable current over an appreciable time if a ground fault occurs on the secondary circuit. Frequently a ground fault of this last type does not pass current of sufficient magnitude to operate protective equipment, with the result that the ground connection is required to carry current over an indefinite period. The problem includes dissipation of a rather large amount of heat which may be of sufficient duration to introduce a consideration of thermal conductivity. If ground currents of this type are anticipated the grounding system must of necessity cover a relatively large area to keep the current density in the earth at a low value. In special cases it may be desirable to determine the performance of the ground connection by current-loading tests.

[ED. NOTE—This is the eighth in a series of articles on various phases of grounding.]

•

Utility Adds 1,000 Kw. at $25 Unit Cost

By A. H. BARDEWYCK
Assistant Chief Engineer, Cia. de Electricidad de Los Andes, Argentina, S.A.

By installing 1,300 kva of static capacitors on overloaded distribution feeders, and by converting coal-fired boilers to oil firing, Cia. de Electricidad de Los Andes secured an additional 1,000 kw. of utilizable generating capacity at a total cost of approximately $25.50 per kilowatt. Improved power factor of the load allowed an increase of 1,000 kw. in the capacity of one of the generators and oil firing was all that was necessary to increase the boiler capacity this same amount, the turbine already having sufficient capacity.

Study of the utility's system indicated an ability to handle a peak load of 10,100 kw. at 0.77 percent power factor, which would have been inadequate to handle an expected load of nearer 11,000 kw. In addition a voltage drop problem arose on three distribution feeders supplying a large number of motors operating at low power factor.

Consideration of possible solutions to the power supply problem—adding boiler capacity, installing new turbines, etc.—led to the adoption of the selected method, both from a standpoint of costs as well as from the expediency with which corrective methods could be applied.

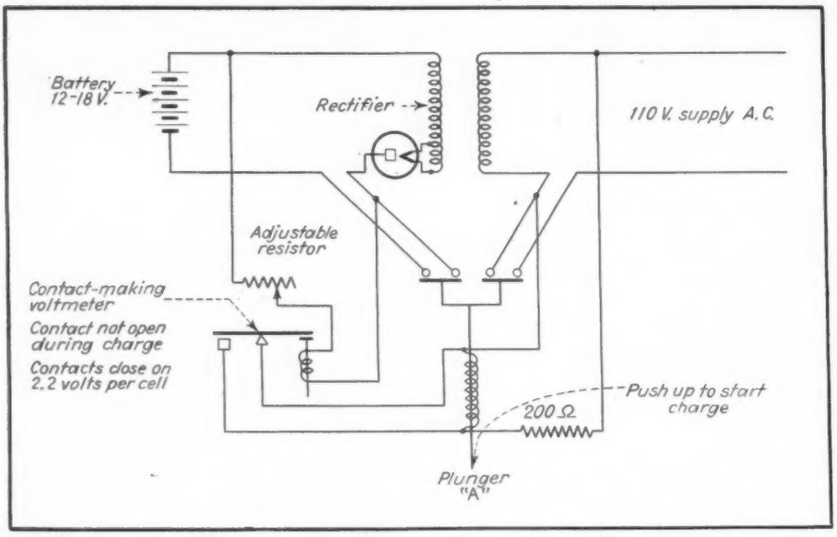
Five 200-kva., 5-kv. capacitors were installed on the three distribution feeders; two 150-kva., 13.2-kv. units elsewhere made up the remainder of the 1,300 kva. The capacitors were installed in existing substation vaults and connected to existing lines by means of fused cutouts. With the adopted solution, it is now possible to handle a peak load of 11,100 kw. at 9,200 rkva.

•

Charging Control for Small Batteries

Once placed "on charge," the small, low-cost, 12- to 18-volt batteries at unattended substations of the Nebraska Power Company are automatically tripped off when battery voltage reaches 2.2 volts per cell by a simple "charge controller" in each charger circuit. While good tripping service is demanded of these batteries their low cost does not justify elaborate maintenance. The device, to be described, permits a maintenance man to drop in at the substation once a week, trip the control to "charge" and leave termination of the charge to the automatic control.

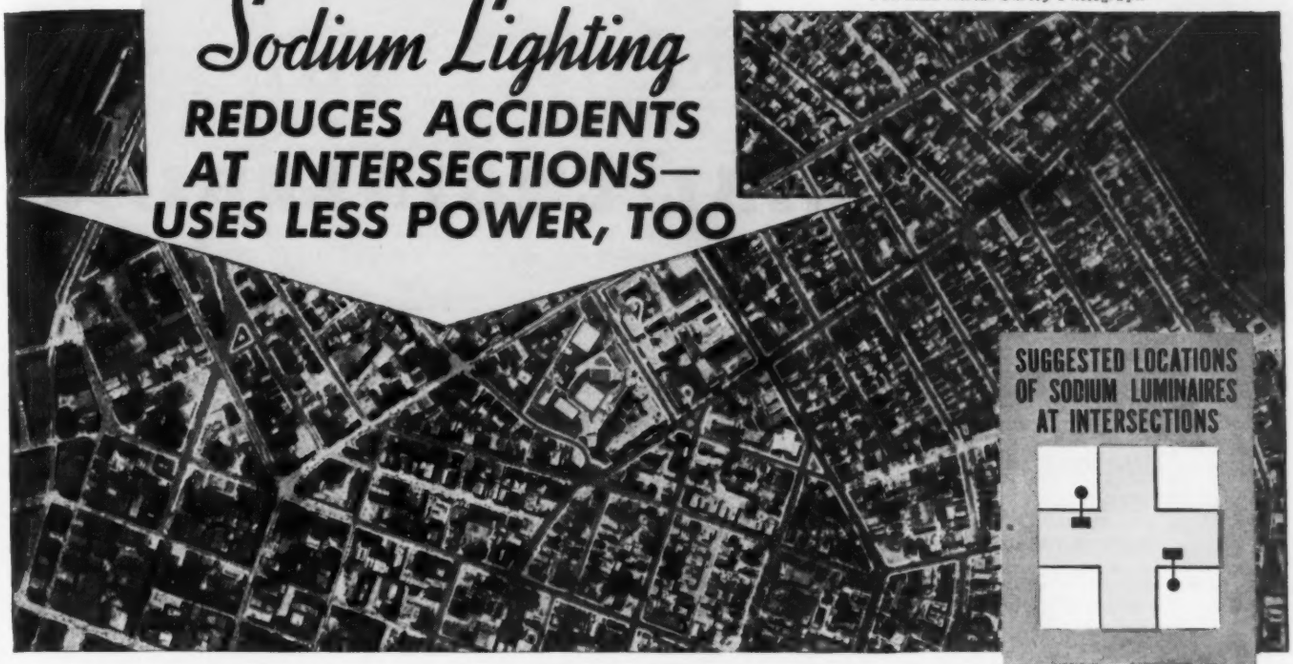
To place the control in operation plunger "A" is pushed up, closing contacts in both primary and secondary sides of the rectifier supply transformer circuit and sealing-in a holding coil that keeps the transformer contacts closed during charge. When battery voltage builds up to 2.2 volts per cell the coil of a contact-making voltmeter "picks up," closing contacts (normally open during charge) that short circuit the holding coil mentioned. This allows the plunger in the holding coil to drop, disconnecting the charger from the line. A 200-ohm resistor is in series with the holding coil to limit voltage across it to safe limits and to limit the current through the contact-making voltmeter contacts when closing.



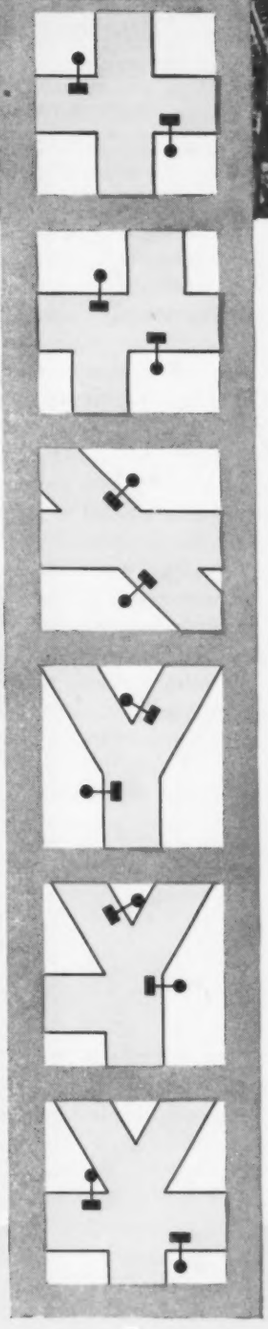
SIMPLE CIRCUIT terminates charge when batteries in unattended substation recover full voltage

Sodium Lighting
REDUCES ACCIDENTS AT INTERSECTIONS— USES LESS POWER, TOO

Fairchild Aerial Survey Photograph



SUGGESTED LOCATIONS OF SODIUM LUMINAIRES AT INTERSECTIONS

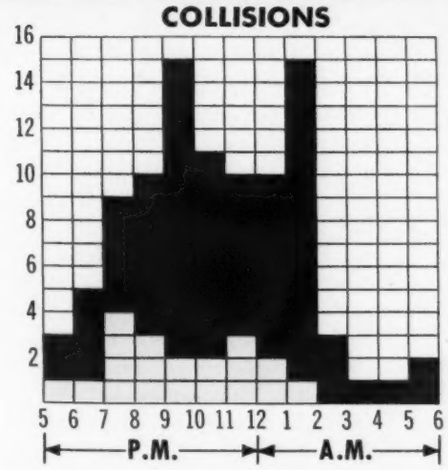


IF IT takes close figuring to get adequate traffic-safety lighting out of your present system capacity, consider sodium lighting for dangerous intersections.

Los Angeles, because of its exceptionally high ratio of motor vehicles to population, has a difficult problem. Analysis of accident records showed that most of the collisions occur during darkness at intersections. So sodium lighting was installed. The result? Hazards of night driving definitely reduced—by well-distributed illumination plus the caution color to signal approaching motorists.

Intersection lighting with G-E sodium luminaires isn't expensive. Typical intersections (diagramed at the right) can be illuminated with only two luminaires, if traffic is evenly divided. A map of your city will show similar danger zones. Call on the nearest G-E lighting specialist for help. General Electric, Schenectady, N. Y.

FOUR YEARS OF TRAFFIC-ACCIDENT RECORDS AT 25 LOS ANGELES STREET INTERSECTIONS
Two Years Before and Two Years After Installing Sodium Lighting



GENERAL ELECTRIC

152-18-3010

INDUSTRIAL ENGINEERING

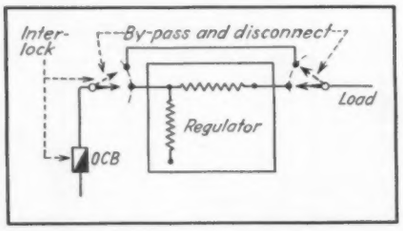
Switch By-passes Transformer

By ARTHUR PALME
Power Transformer Engineering Dept.,
General Electric Co., Pittsfield, Mass.

A disconnecting switch that will by-pass a regulating transformer in those infrequent instances when it is being serviced by the maintenance crew was specially designed for an equipment furnished recently to a large Southern industrial plant.

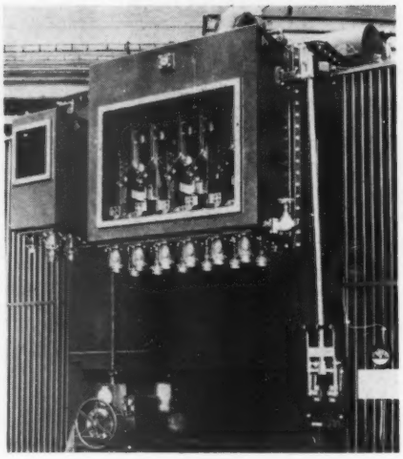
The switch requested was to be of the oil-immersed type, rated 15,000 volts, 1,200 amp., for direct mounting on a 27,800-kva. regulating transformer. The special requirement was that it should permit continuity of power supply while the transformer is disconnected for servicing.

To serve the purpose, two sets of triple-pole, double-throw, gang-operated, oil-immersed knife-switches were mounted on a steel panel. Their poles were connected to one incoming cable, one outgoing cable and the transformer. When the switches are



SCHEME of connections for by-passing regulating transformer during maintenance

in the lower contacts unregulated power comes in over one cable, goes into the transformer and emerges regulated through the other cable. When turned into the upper contacts unregulated power comes in over one cable and is immediately by-passed through jumpers into the outgoing



BY-PASS and disconnect switch mounted on transformer

cable, entirely isolating the transformer.

The switch is not designed for current-interrupting duty. For this reason the operating handle of the switch is locked in the operating position and cannot be moved until the high-voltage oil circuit breaker has been tripped open. A transforable key is used to provide an absolutely dependable interlock.

•

Transfer Airport Load Among Three Circuits

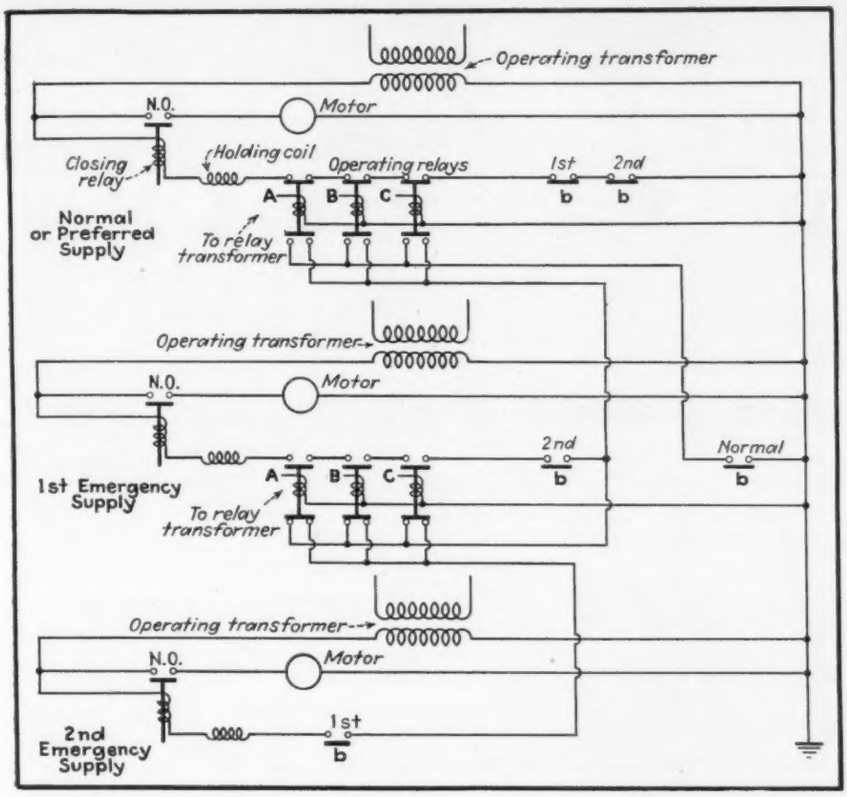
As commonly applied to rural and industrial substations, conventional automatic load transfer systems provide for the switching of load between two synchronous lines—one a preferred and the other a standby or emergency circuit. As an added protection against service interruption a large midwestern airport recently adopted an extension of this arrangement which provides for automatic transfer of load from a single preferred line to either of two reserve lines in 10 cycles time from the loss of voltage on the principal feeder.

While the system used is a relatively simple extension of the conventional arrangement, it offers advantages in service reliability which recommends it to use in continuous-process industries where continuity of service is a prime consideration in power system design.

Relay System

A schematic diagram of the relay system is shown in the accompanying diagram. Under this arrangement operation of the three 400-amp. oil switches is controlled by relays which operate in case potential on the line supplying load drops below a normal value determined by the relay setting. With the load supplied by the preferred line, for example, if the line fails for any reason the switch transfers load to the first emergency line, providing it is energized, but if not, then to the second emergency line. As the circuits are restored relays return the load to the "most preferred" circuit that is energized. In returning to the preferred circuit the switch on the emergency circuit opens to interrupt load before the preferred line switch closes in. Electrical interlocks prevent any two switches being closed simultaneously.

Potential indication on the preferred and first emergency circuits is by means of V-connected potential transformers. However, no potential transformers are used on the second emergency line since the failure of voltage on this line results in an outage unless the preferred or first emergency circuits have become alive in the meantime.



AUTOMATIC switching scheme provides preferred and first and second emergency supplies for airport load. Connections are shown for normal operation. Interlocking contacts "b" are actuated by mechanical action of main power switches. N. O. = normally open contacts

Power for the switch-operating torque motors is provided by a separate power transformer in each of the three relay circuits. A holding coil is provided in each circuit to hold the switch closed. De-energizing the holding coil with loss of voltage allows the switch to drop open.

The oil switches used in the airport installation were manufactured by the Electrical Engineers Equipment Company of Chicago and are 400-amp., four-pole units (three phases and neutral) and carry an interrupting rating of 10,000 kva., although they are not used for short-circuit interruption service. Each switch has its own tank and mechanism, but all three are mounted in a common frame, 9 ft. long, 5 ft. high and 46 in. deep over all. They are used on 4-kv. underground feeders which supply the airport. In addition to the electrical operation provided by the relay motor arrangement all of the switches can be manually operated.

Provision has also been made for connecting any one of the three power feeders to the main airport supply bus to permit maintenance of the switch units without interruption of load.

•

Bus-Type Wiring Used for Electric Furnace

Simplicity, ruggedness and accessibility, as well as assurance of non-magnetic supporting structures, are typified by the bus-type wiring serving the alloy steel furnace of the Pacific States Steel Corporation at Niles, Calif. The furnace is served from a 5,000-kva., three-phase, 2,400-volt primary, 15,000-amp. secondary furnace transformer. Power is obtained from Pacific Gas & Electric Company's 60-kv. subtransmission network through a bank of three 2,500-kva., single-phase, 60/2.4-kv. transformers.

Service to the furnace transformer is brought underground from the main switchboard to the simple bus arrangement shown in the accompanying picture for connection to the transformer primary windings. The secondary bus consists of seven $\frac{3}{8}$x6-in. copper bars per phase mounted on non-magnetic supporting structures.

PRIMARY transformer bus connected to switchboard through underground cables (left); secondary bus from transformer to furnace is shown at right

LOAD BUILDING

Lighting "Surgery" for Industrial Operations

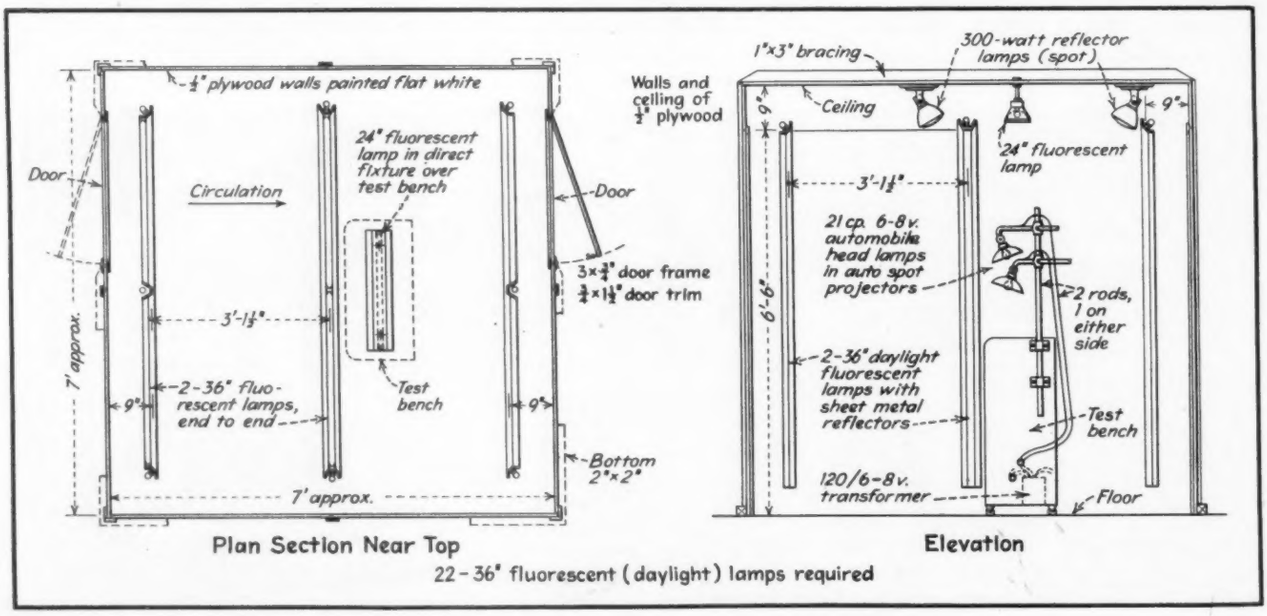
To help industrialists in and around Chicago work out lighting problems arising from intricate manufacturing operations the Chicago Lighting Institute has recently added a unique industrial lighting "surgery," or "operating room," to its regular industrial lighting laboratory. Feature of this "surgery" is an unusually flexible direct and indirect lighting system using both fluorescent and incandescent which can be used in a number of combinations to yield as high as 2,600 ft.-candles on concentrated areas.

The "lighting surgery" is a plywood cubicle, roughly 7 ft. on a side, painted flat white inside, and lighted by daylight-quality fluorescent lamps in an indirect trough reflector to give general illumination of exactly 100 ft.-candles at every point in the cubicle. Fixtures are arranged, as shown, on the four walls and ceiling and are separately switched to give the ultimate flexibility for experimental purposes. A separately switched, direct fluorescent fixture, two 300-watt incandescent reflector lamps and two 6-volt spotlights are used to build up extreme lighting intensities.

The lighting surgery has been useful in working out such lighting problems as disclosure of diagrams scribed on specular metal, tin, aluminum, steel—a common problem in sheet metal working industries and toolrooms—and in developing proper lighting for objects with deep recesses such as hollow cylinders, core castings, interior threads, tapped holes, etc. These two lighting problems require diametrically different approaches and illustrate the flexibility of the new lighting surgery.

For disclosure of scribed diagrams on specular metal the cubicles' indirect trough lighting seems to be the best solution. Under indirect light sheet metal reflects a large low-brightness area (the ceiling) and "glows" with a fairly uniform intensity. Scribed marks pick up some light from vertical walls, but reflect it in all directions. Very little is directed to the eye. Lines consequently appear dark and easily legible. However, when incandescent spotlights are trained on the area, light from the surface of the metal is reflected to one side, while that from scribed marks and other scratches is reflected toward the eye, disclosing *all* scratches, scribed or accidental, in confusion.

Where objects have deep recesses



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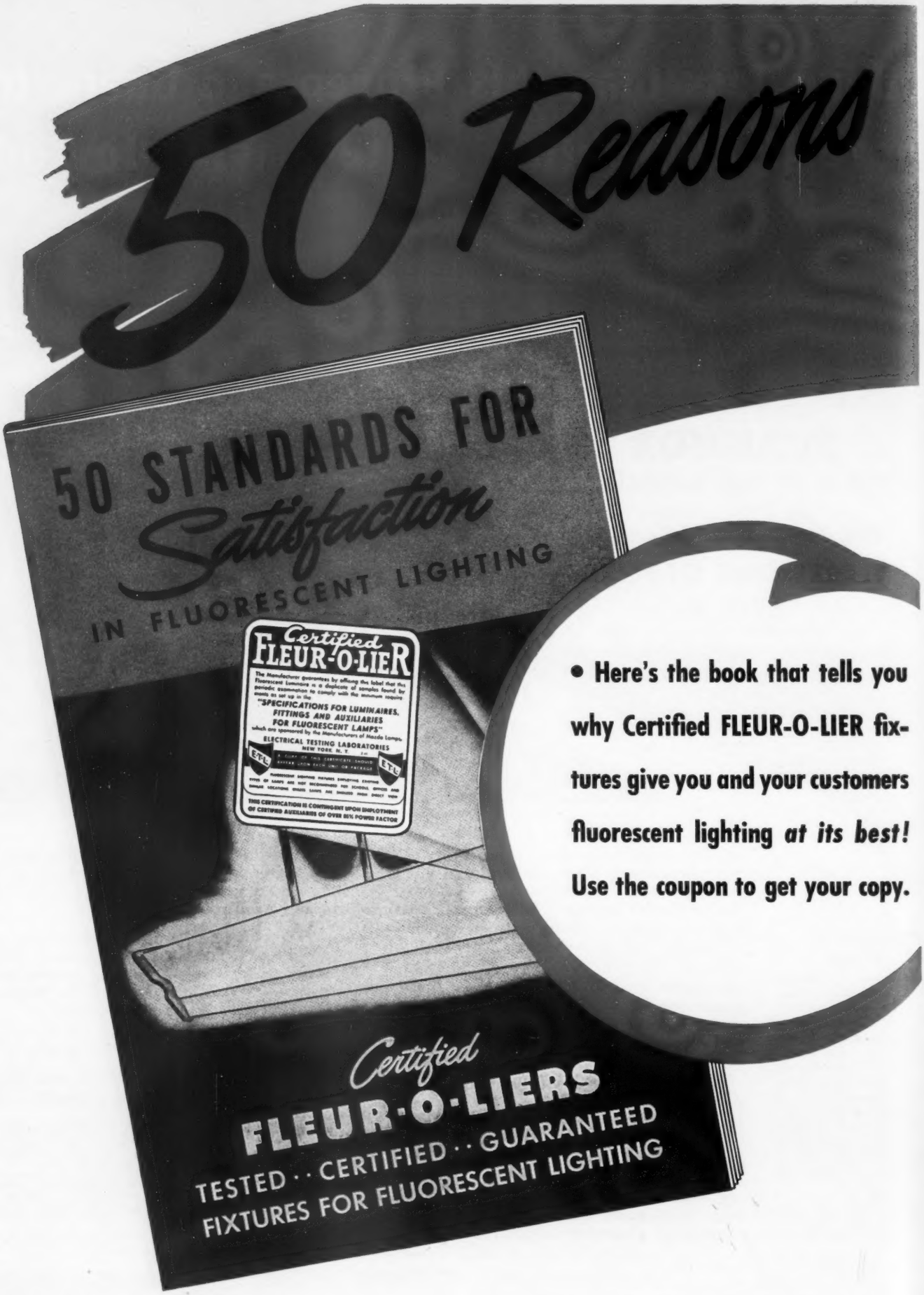
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projected light is the only type that will penetrate to the bottom of the cavities. The projector lamps and spot lamps in the cubicle are effectively used to work out good lighting for problems of this type.

High-intensity lighting, obtained in the cubicle from the 300-watt ceiling-mounted projector lights and the 6-volt automobile spotlights, can be used to give a magnifying effect, where small-minute objects could not be seen at all under low intensities. If minute parts are illuminated with 2,500 ft.-candles, and care is not exercised, glare from the object or background may prevent the eye from seeing what is required to be seen. This order of illumination may still be used, if background lighting is carefully worked out.

For example, an object illuminated to 2,500 ft.-candles may require a surrounding field of several hundred foot-candles to reduce background contrast, but this field cannot be a large one, and surrounding it again should be another field of an average brightness somewhere between 1/10th and 1/20th the brightness of the field for which it forms a background.

•

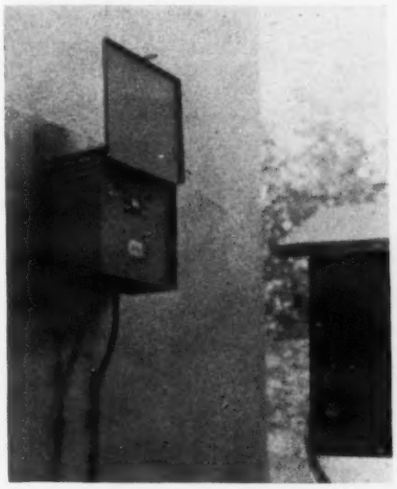
"Cathodic" Unit Prevents Corrosion

By L. M. DURYEE
Industrial Power Engineer
Connecticut Light & Power Co., Waterbury

Every five years the Naugatuck (Conn.) Water Company found it necessary to paint the inside of a 200,000-gal. storage tank to prevent damage from corrosion, and this job cost $1,000 besides taking the tank out of service. William H. Moody, general manager of the company, investigated methods of reducing this maintenance cost, and as a result installed a "cathodic" protective device last spring which consumes but 25 kw.-hr. per month for each electrode and eliminates the need for painting.

The unit converts 110-volt a.c. energy to low-voltage d.c., using the tank as the cathode and three anodes in the water. Each anode is 2.5 in. in cross-section and 7 ft. long. The tank is 30 ft. in diameter and 40 ft. high. In its operation the cathodic protector brings about a minute plating action within the tank which

maintains a delicate balance of mineral deposit on the inner surface. Only this slight electrolytic action is required to keep the tank corrosion-free. The first reaction when the current is turned on is the formation of hydrogen bubbles at the surface of the tank. Gradually hydrogen gives way to a slight mineral deposit, which



CONTAINER on tank for a.c.—d.c. unit which eliminates internal surface painting

is kept under perfect control by the allowable current which flows from the d.c. output side of the equipment. Preliminary tests conducted on the mineral content of the water before the installation was made indicated conclusively that this new application of an old electrical principle would retire the equipment investment in something less than four years. The protective device is a product of the Rusta Restor Corporation, Fremont, Ohio.

•

Strap-On Heaters for Low Income Group

Convinced that many of its low-income customers who had been using furnace oil or other water heating equipment would become electric water heating prospects if low-cost equipment was available to convert their old equipment to electric operation, Wisconsin Public Service Company late last year pioneered the development of a conversion "kit" which it now retails at $44.50.

This kit, installed complete by the company, consists of a 1,000-watt strap-on heater, surface-type adjustable thermostat, plastic insulating jacket and shut-off and pressure-relief valves for the cold water intake.

A number of these heaters were installed during 1940 in employees' homes to test their operation. A careful record was kept of these early experimental installations and data from several typical installations are summarized in the accompanying table. These data reveal an average efficiency for the strap-on unit of 3.8 gal. per kw.-hr. when applied to tanks of 40 gal. capacity. Revenue from such installation, to which the 1-cent water heating rate applies, averages $2.54 per month for families ranging in size from three to six members. Efficiency of the strap-on unit of 3.8 gal. per kw.-hr. compares not unfavorably with an average of slightly over 4 gal. per kw.-hr. for design heaters of comparable size, it is stated.

Of the installations in the accompanying table all but one (Case No. 3) were satisfactory. In this case—where a 750-watt instead of a 1,000-watt heater was used—the user reported shortage of water on wash days and slow recovery.

While it might appear that the conversion unit would cut into the market for design heaters, this is avoided through careful merchandising. No concentrated effort has been made to campaign the conversion heater. It is sold only in cases where it is evident that the customer would not be able to purchase the higher-priced design heater and was being forced to continue with a furnace coil installation or accept substitute heating.

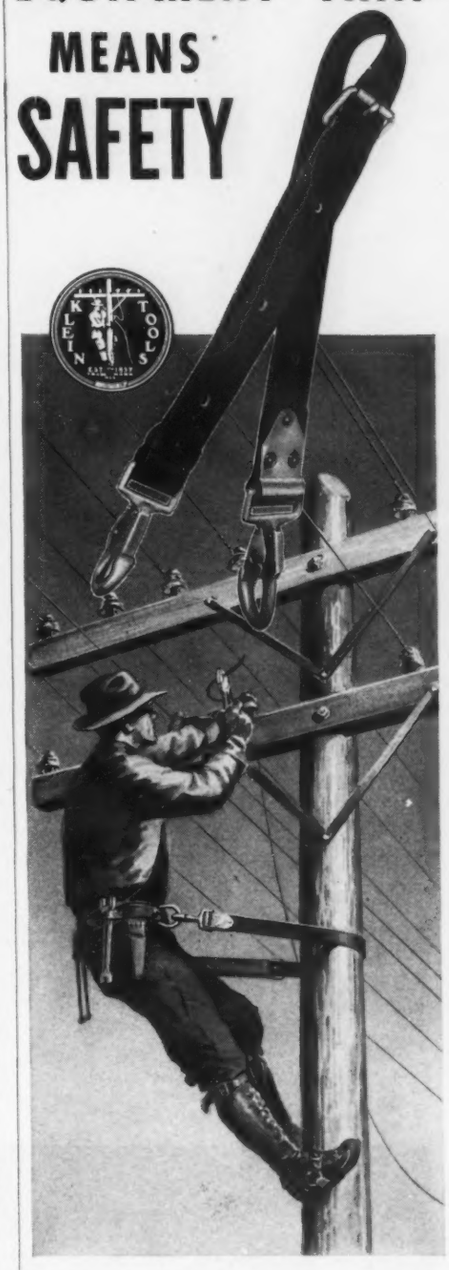
Under the company's merchandising plan 75 percent of the increase in the customer's monthly bill for a two-year period can be applied against the cost of the equipment. It is thus possible for the customer to earn the entire cost of the heater. About 50 have been sold in this way.

Summary of Trial Installations

	1	2	3	4	5
Size of family	5	4	4	3	6
Tank size, gal.	40	40	40	40	40
Element, watts	1,000	1,000	750	2–500	1,000
Insulation, in.	2-in. felt	2-in. felt	2-in. felt	—	—
Av. mo.* cost; dollars	3.03	2.18	2.68	2.66	2.17
Average temp., deg. F.	—	150	145	133	140
Gal. water per kw.-hr.	3.76	3.478	3.899	4.13	—

*Average monthly operating cost for 4 mo., April, May, June, July.

EQUIPMENT THAT MEANS SAFETY



WHEN your life depends on a strap no wider than your three fingers, it's important that every inch of it is the finest human skill can make. The painstaking care that enters into the manufacture of Klein-Kord Safety Straps—the rigid inspection that each one is subjected to—is your assurance that when you throw your weight back, your strap will hold you fast.

Your copy of the Klein Pocket Tool Guide will be sent on request.

ASK YOUR SUPPLIER

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3200 Belmont Avenue, Chicago, Illinois

NEW ENGINEERING IDEAS

Mercury Control Has High Power Step-Up

By K. A. OPLINGER
Research Engineer, Westinghouse Electrical & Manufacturing Company, East Pittsburgh, Pa.

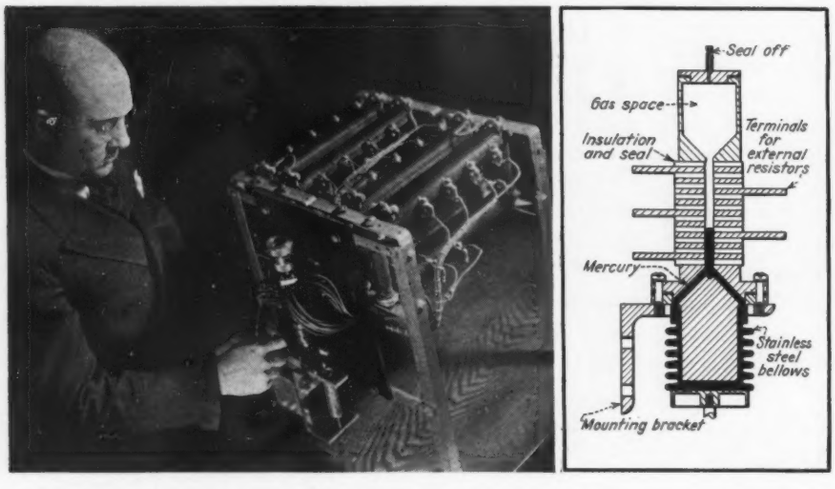
With a power amplification of 100,000 a totally inclosed column of mercury that rises and falls to actuate electrical contacts sealed into the column, has been turned experimentally into a new control device that may form the basis for a new and versatile system of regulating motor speed.

A stainless steel bellows below the mercury column acts as a reservoir; electrical contacts, spaced roughly $\frac{1}{32}$ in. apart, are sealed into the column. As the bellows is compressed the mercury rises and successively short circuits the contacts, thus forming a series of mercury switches. By selecting a large ratio of bellows area to capillary cross-section a slight compression of the bellows is sufficient to raise the mercury the full height of the tube.

The bellows can be actuated by a mechanical driver, such as a cam or lever, so that it can be employed as a speed-control device, with the tube contacts controlling a motor rheostat. An electro magnetic element can be used to make it respond to changes in voltage or current.

Because there is low voltage between adjacent contacts and because these contacts are sealed in a hydrogen atmosphere relatively large currents can be handled.

The device was tried on a 220-volt d.c. circuit and the current was varied from 12 to 30 amp. After five million operations the contacts showed no sign of wear.



"MERCURYSTAT" control device (left) employs 40 electrical contacts spaced along a vertical tube containing mercury. In this experimental single-phase model (right), 0.015 in. bellows movement covers or uncovers all the contacts, a ratio of about 150 to 1. Change of 0.05 watt in coil driving bellows will raise mercury column to full height and the change in power controlled may be 5,000 watts, giving a power amplification of 100,000

Regulator Relay Betters Voltage

By eliminating pivots, all bearings save one, and a multiplicity of adjustable elements from the conventional contact-making voltmeter used on modern feeder voltage regulators, and substituting a novel "integrating contactor" for the usual seal-in coils and secondary relays, Allis-Chalmers has achieved a regulator voltage-control design for which easier adjustment, closer voltage control and reduced maintenance are claimed.

Balancing of the beam for different voltage levels is achieved by using a rheostat in series with the voltage sensitive solenoid instead of by adjusting the tension on balance spring. Only one of the two contacts which actuate the secondary relays—to run the regulator motor up or down—is adjustable, the other is fixed.

A new element known as an integrating contactor allows a very narrow setting of the voltage control relay. Essentially the integrator is a small split-phase, induction disk motor operated directly from the voltage control relay. The motor is started when either the "raise" or "lower" operating coil is energized by contacts on the voltage control relay.

If the "raise" operating coil is closed the disk rotates at a uniform speed, bringing a tripping position around to close a switch operating the regulator motor. If the "lower" coil is closed the disk runs in the opposite direction and the lower switch operates the regulator.

The integrator is brought back to center position by an auxiliary switch which is closed as soon as the disk runs off the center position. The

Hot Wires at the Arsenal's Main Switch!

There should be a brilliant and thrilling chapter on the achievements of the electric light and power industry when the story of this defense effort comes to be written.

Here at Line Material, we see it from an unusual vantage point—close enough for sharp detail—remote enough for good perspective.

For our work is often where former capacity must suddenly be doubled or tripled overnight . . . where gigantic munitions plants must be served without delay.

We see the fight and drive and technical strategy of men who accept seemingly impossible assignments. But somehow, they manage to make delivery at the main-switches of immense new war-tool factories . . . the myriad outlets of normal industry . . . and yet maintain the usual domestic service.

Apparently, the time is yet to come when the final limit of the industry's strength and ability can be fully measured.

LM

LINE MATERIAL COMPANY

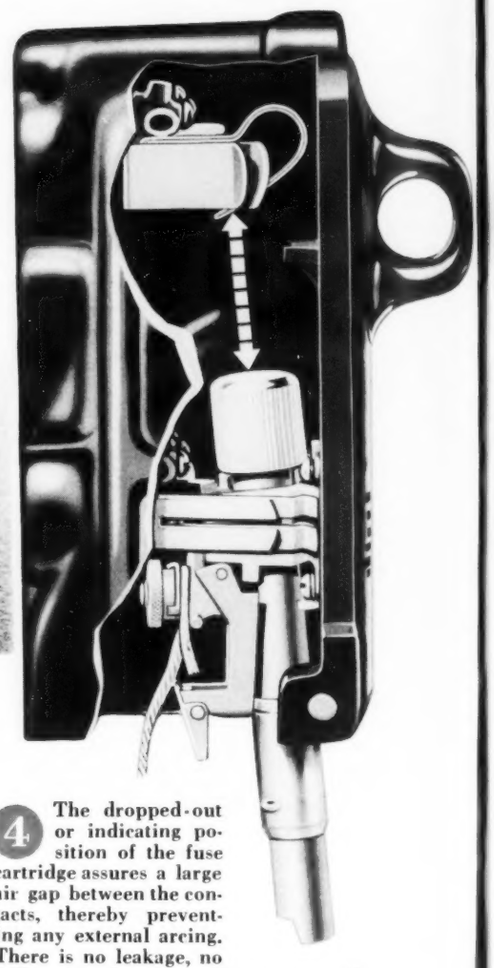
The L-M "P.V.D." the ONLY

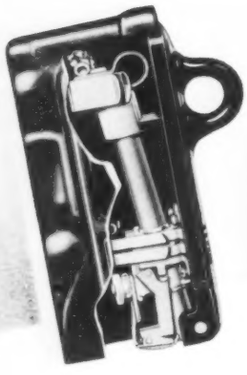
Read These

Find Out Why It Is

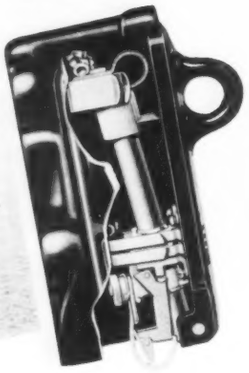
Like all Line Material Fuse Cut-outs, the L-M "P.V.D." is of basically sound construction. This is the normal result of over 20 years pioneering and established leadership in fuse cut-out research.

The illustrations and explanations which follow illustrate and describe its construction, performance, and service features which make it possible for us to say "it is the only cut-out of its kind."

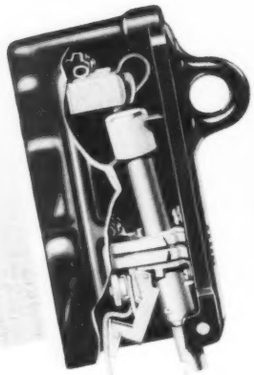




1 The "P.V.D." Cut-out is always protected. The rugged Bakelite door remains closed even after the fuse link has blown. Its contacts assure safe, cooi operation because they are always sealed from weather, dirt, and corrosion.



2 One of the most important features of the "P.V.D." Cut-out is the link flip-out device which assures instant separation of the blown fuse link parts before the latching lever releases the tube to the indicating position. There is a positive time delay. The flip-out device snaps down, the blown link is separated instantly.



3 In the "P.V.D." Cut-out the arc is cleared inside the tube before the contacts separate. This is because of the split-second action which follows the separation of the blown link. The latching lever releases the tube, permitting it to drop to the indicating position. The upper contact follows this tube when dropping and, therefore, maintains contact during a good portion of the downward travel of the tube. This absolutely assures the arc being cleared before the contacts separate.

4 The dropped-out or indicating position of the fuse cartridge assures a large air gap between the contacts, thereby preventing any external arcing. There is no leakage, no radio interference. Because metal slides on metal when the cartridge drops, it operates smoothly without sticking, which assures dependable, positive operation under all weather conditions. In addition to this, the dropped-out position is a signal easily seen from the ground and prevents hunting for the cut-out with the blown fuse link.

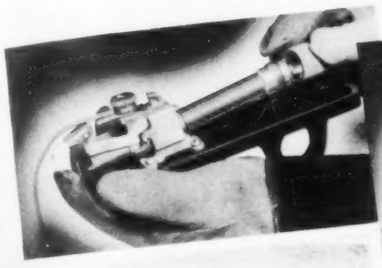
30 Years of Line Material Service

CUTOUT of its KIND!

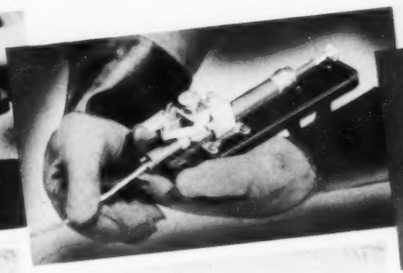
Illustrated Explanations Of Its Features

Better..Learn How It Saves Time and Money

Another advantage of the L-M "P.V.D." Fuse Cut-out is the time saved in restoring outages. The "P.V.D." can be re-fused in one minute—a safe, easy operation done right on the pole.

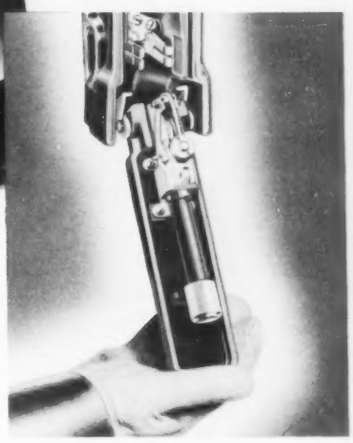


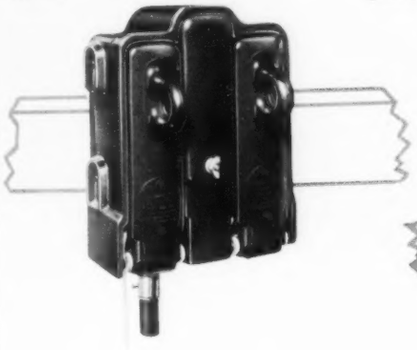
5 The Bakelite door of the "P.V.D." lifts off the dead hinge in one easy movement. The fuse cartridge cap is easily unscrewed and the removal of the blown link is a matter of seconds.

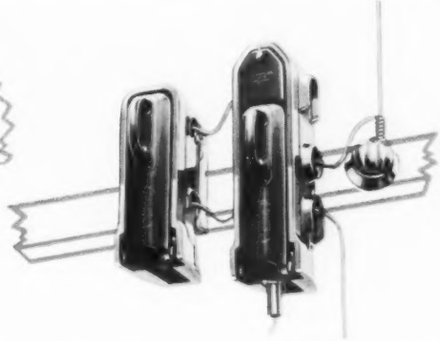


6 The new fuse link slides into and through the "P.V.D." fuse cartridge without a hitch. It is only necessary to replace the fuse cartridge cap.

7 Once the new link is inserted, it is simply a matter of seconds to pull it over the spring-actuated flip-out device and fasten it with the knurled nut.





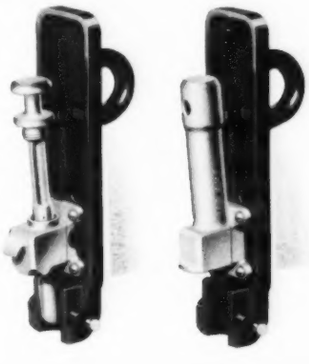


8 When this is done, hook the door back onto its hinge and swing it shut in one continuous, easy movement. The entire operation of re-fusing can be done by any lineman in sixty seconds.

9 Probably one of the biggest advantages of the "P.V.D." family is the fact that its Bakelite doors are inter-changeable for use with the RP-2-56, and RP-515 reclosing cut-outs. This interchangeability means savings in reduced inventory and time in restoring outages.

Coordinate your Fusing with L-M LINKS

10 And here is another distinctive advantage. By simply removing the door and replacing it with a door with a switch blade attached, the "P.V.D." cut-out is instantly converted into a disconnect switch with a stationary arm an indicating switch blade.

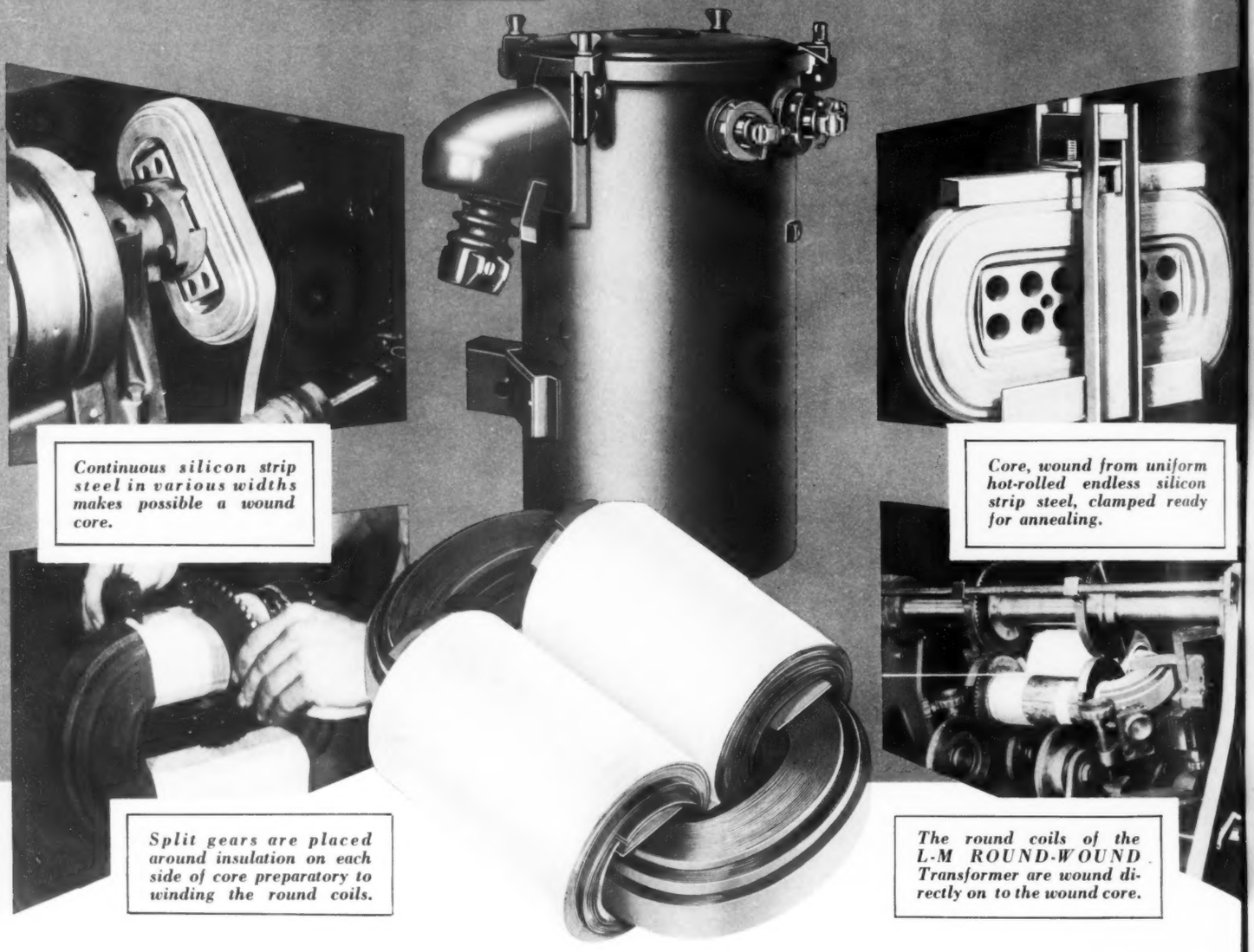


When you standardize on L-M Cut-outs and coordinate your fusing with L-M Links, you put yourself in a position to save more time and money than you can with any other make of cut-out. Write for special bulletins covering in detail L-M Fuse Cut-outs, or secure full explanation from your L-M representative.

LM

LINE MATERIAL COMPANY

IT'S THE WAY IT'S BUILT THAT MAKES THE L-M ROUND-WOUND TRANSFORMER A BETTER TRANSFORMER



Continuous silicon strip steel in various widths makes possible a wound core.

Core, wound from uniform hot-rolled endless silicon strip steel, clamped ready for annealing.

Split gears are placed around insulation on each side of core preparatory to winding the round coils.

The round coils of the L-M ROUND-WOUND Transformer are wound directly on to the wound core.

It Offers You MORE Because Of Its Inherently Correct Design, Fine Materials, Superior Production Methods

There are other modern distribution transformers, but no other distribution transformer is designed and built quite the same as the L-M ROUND-WOUND Transformer.

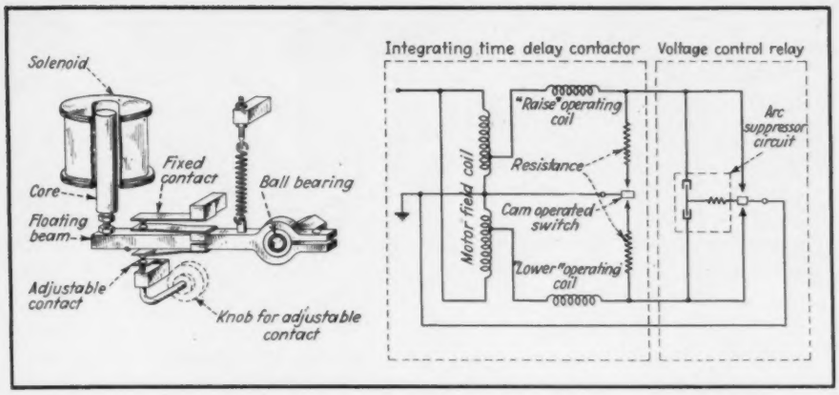
L-M engineers have developed a method whereby they secure an inherently ideal combination of coil and core assembly. In addition, L-M ROUND-WOUND Transformers are being produced in the most modern manner. The resulting advantages to you are:

1. *Better regulation at all power factors.*
2. *Better ratio of losses.*
3. *Uniformly low exciting current.*
4. *Uniformly high impulse strength.*
5. *High short-time over-load capacity.*

The L-M ROUND-WOUND Transformer is built in accordance with the new NEMA specifications and is available in 1½ to 25 Kva, 2400 to 7620 volts, ratings.

All of these factors are amplified and technically illustrated in Bulletin LMB-41161.

LINE MATERIAL COMPANY



REDESIGNED contact-making voltmeter has fewer adjustments,—no seal-in coils (left). Integrating contactor replaces compounding coils and secondary relays on regulator voltage control

switch closes in a direction opposite to the direction of disk rotation, energizing an operating coil that gives an opposing torque of lower magnitude than that of the operating coil energized by the voltage control relay, so the integrator continues to run in the original direction.

If the voltage control relay opens, the operating coil energized by the auxiliary switch starts the disk back toward the center position at approximately the same speed that it ran ahead. Thus the integrator disk runs ahead when voltage control relay is closed and returns when the voltage control relay opens. As a result, it adds up the time that the voltage control relay is closed, and if it is closed more than it is open the driving motor of the regulator is energized to correct voltage.

The circuit is temperature-compensated so that voltage will be held practically constant through a temperature range of minus 20 deg. F. to plus 120 deg. F. Variation is always less than ½ volt and considerably less over the normal operating range.

•

Double Dead-end Serviced While Hot

Either string of a double-dead-end can be removed from an energized line by means of a new Kearney live-line tool. Demonstration was given recently by the regular live-line crew of Metropolitan Edison Company under supervision of Thomas Bowen for the J. R. Kearney Corporation. The tower was on a 110-kv. double-circuit line.

The device consists essentially of two clamps to be attached to the dead-end yokes and 1½-in. diameter tension rod and two other wood rods to form a cradle for the released string of insulators. It has an 8,000-lb. tension rating and in the accompanying tower picture was sharing with the undisturbed string the tension of a 1,900-ft. span of 336,000-cir.mil ACSR.

After the clamps are firmly attached to the yokes by means of conventional live-line tools the tension in the rod is created by crank-handle on threaded nut until the cotters can be removed from the defective string. The tool is reversible for use on the alternate string; longer rods are provided in the 220-kv. pattern.

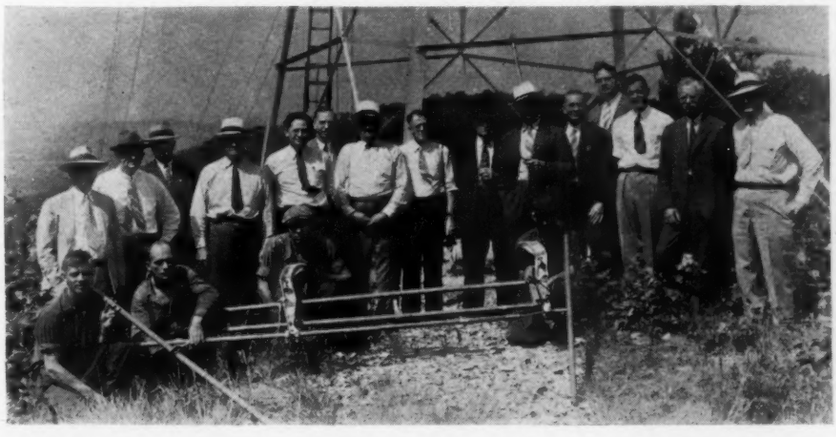
•

Abrasive Protection for Cable Sheath*

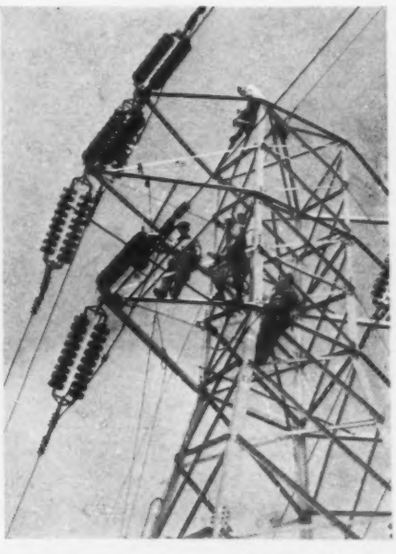
Conditions of voltage and electrolyte composition under which the tetragonal or red modification of lead monoxide is formed at room temperature were subjects involved in the study of formation of lead monoxide as a cable sheath corrosion product. The studies were made by Edgar F. Wolf, assistant to superintendent, electric testing department, Consolidated Gas, Electric Light & Power Company of Baltimore, and Charles F. Bonilla, associate professor, department of chemical and gas engineering, Johns Hopkins University, according to a recent paper presented to the Electrochemical Society.

"Low salt concentration, voltage below one volt, and low solubility of the lead salt of the corroding anion are found to favor red lead monoxide formation. The heaviest yield of lead

* From "Formation of Lead Monoxide as a Cable Sheath Corrosion Product," Electrochemical Society, presented at Cleveland, April, 1941.

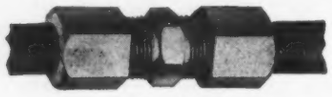


CLAMPS attach to double-string yokes; tension carried by lower rod; two upper rods form cradle to support released string. Group comprises staffs of Metropolitan Edison, Pennsylvania Power & Light, Pennsylvania Water & Power, Sardoni Construction and J. R. Kearney Corporation



ONE STRING of double-dead-end removed while line tension is shared by remaining string and the new dead-end tool

You wouldn't make a gas connection with a set screw connector. An electrical connection is just as important.



Stop those current losses with a connection that grips the cable like a Gorilla. The principle of the nut and wedge are used for a maximum compression. Dependable locking action in every conductor. Pressure is uniformly distributed over full contact area.

A "Gorilla Grip" Connector requires no special tools and may be used over and over again without loss of efficiency. Investigate, write for descriptive literature.

National Electric
PRODUCTS CORPORATION
900 Fulton Building Pittsburgh, Pa.

monoxide with the minimum solution of the anode was obtained in phosphates and silicate solutions in the range of 0.1 *N* and at one volt potential from anode to cathode."

In two typical cases of the formation of tetragonal lead monoxide "corrosion occurred at the point where tin-coated bonding straps were soldered to cable sheaths for electrolysis protection. The copper strap ran along the sheath for several inches. The cables were incased in a $\frac{1}{2}$-in. coating of 1:3 portland cement-sand concrete for fire protection in the manhole." The authors are of the opinion that "corrosion was caused by galvanic action between the tin-coated copper straps and the lead in the presence of moist concrete. The open circuit potentials to lead are given in the following table, in equilibrium with air":

Initial Potential with Respect to Lead Electrode in 1:3 Cement-Sand Concrete	
"Tinned" copper	0.524 volt (cathodic)
Copper	0.491 volt (cathodic)
40-60 solder	0.006 volt (cathodic)

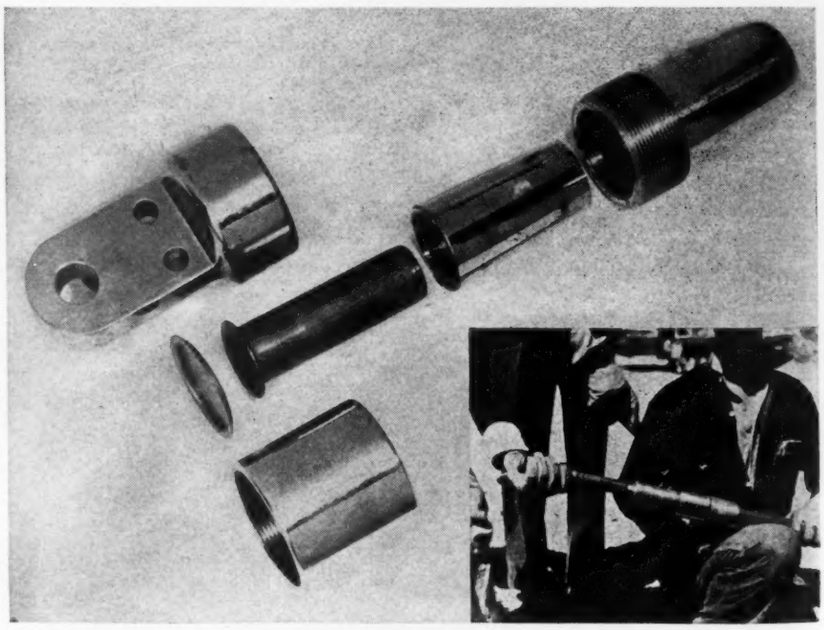
Tests were made of fireproofing materials prepared from mixtures of quartz sand with a large number of brands of portland cement. "All of them produced serious corrosion of lead in contact with copper. High alumina cement produced much less corrosion than portland cement, but it was not free from localized pitting. Under some manhole conditions the high alumina cement fireproofing completely disintegrated within three years. Some trade-name commercial fierproofing preparations were distinctly better than portland cement in regard to corrosion. However, others were quite corrosive."

The analysis has developed a method for producing tetragonal or red modification of lead monoxide in such a way that coatings can be applied to cable sheath as a form of mechanical protection against abrasion.

•

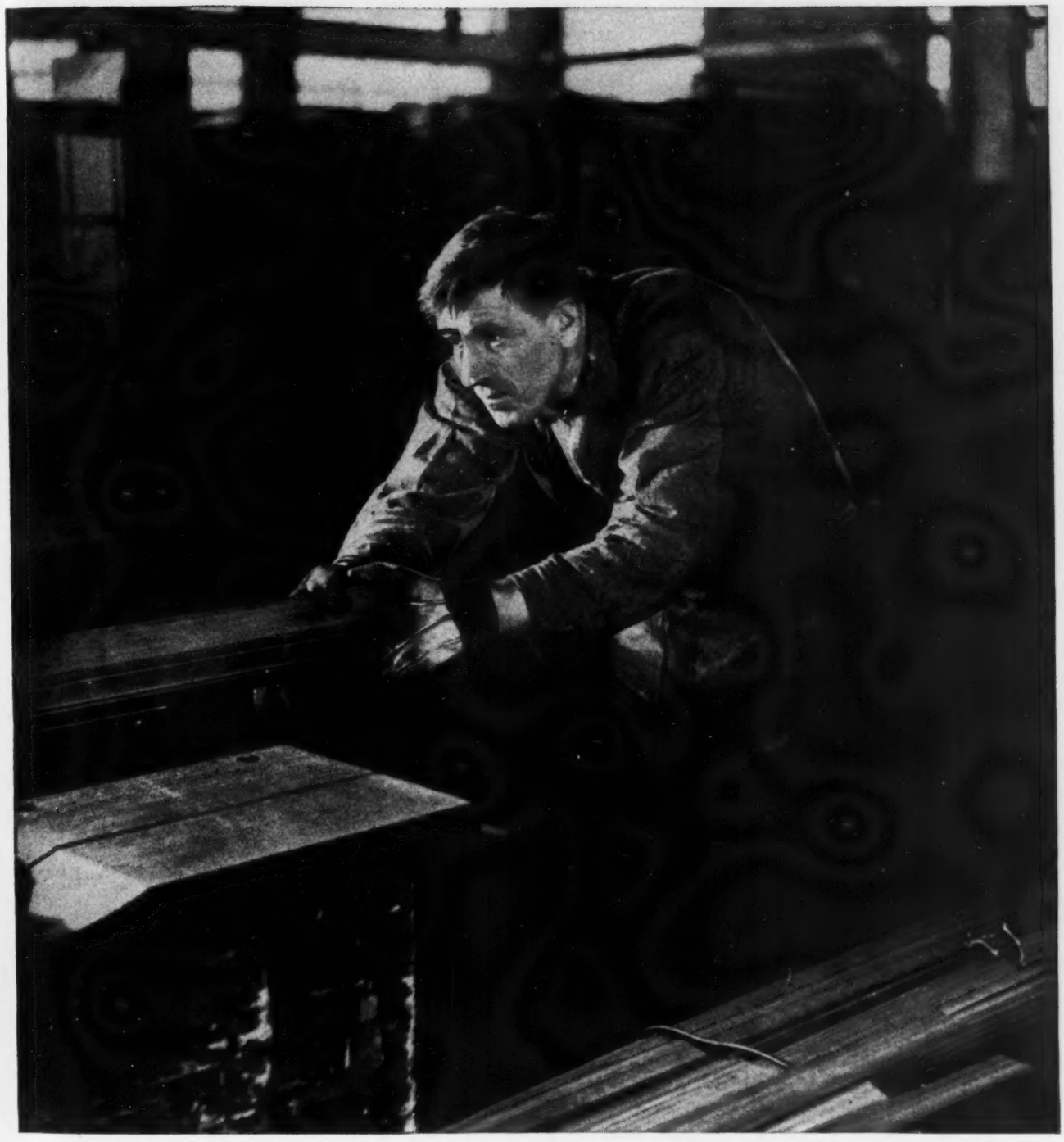
New Hardware on Boulder Lines—I

Unit packages, which form the basis for all conductor connectors, strain clamps, jumper clamps and station bus clamps, are the substance of a now-proved theory of high-voltage line hardware conceived on the first two lines and more fully developed

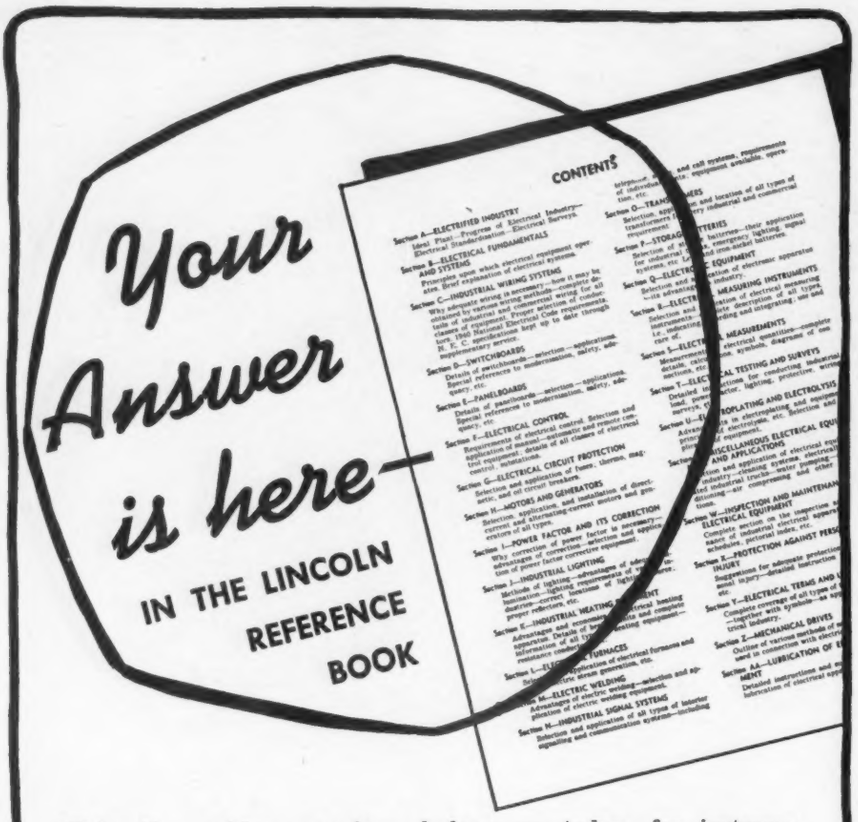


UNIT PACKAGE forms basis of connector and clamp assemblies on 287-kv. Boulder Dam lines

Two unit packages plus a coupling make up a conductor connector. One unit package plus an eye makes a strain clamp. Separate clamps are used for cable and jumper loop, to keep total weight down; each is connected separately to the yoke at the end of the double string of insulators and joined by a flat-flexible copper braid. Jumper clamp or bus station clamp is identical with a strain clamp. To make a conductor connection the parts of a unit package are placed on a conductor end and a small hydraulic press is used to squeeze them on.



A TRUE EYE FOR BRASS. In every department at Revere Copper and Brass Incorporated you will find men who have a "knack" for brass. Men like Peter Gura, for instance, who has been with Revere for thirty-five years—a man whose eye can tell to a hair when a brass shape is out of true, and who can set it straight as a plumb line with a practiced twist of his hands. In operations such as this, which would baffle a machine, Revere sees an opportunity to put an extra ingredient—the *human touch*—into copper and copper-base alloys. That is one of the many reasons why Revere materials are so trustworthy in strengthening America's defense, and why the end of the emergency will find Revere so well prepared for the advancing needs of industry. Revere Copper and Brass Incorporated, 230 Park Avenue, New York.



Take the problem you have before you today—for instance. Somewhere in the Lincoln Reference Book there is a section devoted exclusively to the subject. Complete with illustrations, diagrams, tables and code—all gathered from authoritative sources—all up to date, and all in one book with comprehensive indexes.

WHAT IS IT WORTH TO KNOW?

To know that your next electrical installation will be planned with up-to-date practical information; that it will be the most economical method; that it will meet all requirements; and that installation and servicing difficulties will be avoided? What is it worth to have 1200 pages of factual data, and no advertising, 1200 illustrations, 326 diagrams, 315 tables and the complete Code all classified in 30 sections with a complete index and simple method of finding what you want?

The Lincoln Electrical Reference, compiled by E. S. Lincoln, Fellow A.I.E.E., at the request of leaders in the electrical field, is the result of four years of intensive effort. It is up-to-date now, and will be kept up-to-date by a supplementary service.

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75

on the third 287-kv. Boulder Dam line to Los Angeles, Calif.

Throughout this system, General Cable hollow copper type HH conductor was used. Since all elements of the conductor are on the surface, this cable offers simplified possibilities for gripping, inasmuch as any type of clamp can take hold directly of the conductor even more easily than with concentric strand.

The unit package contains a thin-walled tubular plug which is driven into the center of the cable, a bronze slotted cone that fits over the conductor, an outer fitting with an internal slope that is the same as the external slope of the cone and a flat disk to serve as a barrier against the possible entrance of water. With this system a conductor connector is formed by the combination of two unit packages and a coupling—8½ in. long over all.

Application

In assembly, the elements of the unit package are placed on a conductor end and a small Burndy hydraulic press is screwed on the threads of the outer fitting. This press has a release valve that opens at a pressure equivalent to a tension on the conductor of 10,000 lb.—above maximum design tension. The whole process of cutting a conductor, applying two units of a unit package attaching the press, applying pressure to force the parts onto the conductor and then removing the press, requires less than three minutes. After the hydraulic press has attached the main fittings of a unit package to a cable end the rest of the work is merely a matter of uniting two such connections by means of a coupling to form a connector, or screwing in an eye on one of them to form a strain or jumper clamp.

One additional refinement might be mentioned. The coupling is not provided with a right- and a left-hand thread, as is a turnbuckle. The thread is continuous and is left-hand. The coupling is run all the way back over the threads of one of the fittings. The other fitting on its cable is butted against the first one and the coupling run back over both of them. The advantage of a single, left-hand coupling is that, since the lay of the cable is right hand, the force of the cable is always in the direction of tightening the coupling.

THE AMERICAN COACH & BODY CO.

An Engineering Organization

● Before the first frame member is cut or a single sheet is sheared or punched, our Engineering Department has built the body on paper, complete to the last detail. The size and location of the smallest part are important details specifically disposed of in blueprint form before construction begins.

In scientific planning of this kind, guesswork is eliminated and mistakes are caught before they take form in construction.

The personnel of American's Engineering Department has been recruited mostly from men engaged in public utility service; and in consequence they approach their problems with a full realization of the requirements of the situation.

Not only in design and planning, but at all stages of construction American bodies are constantly under the supervision of engineers. The plant works intimately with the Engineering Department, with the result that all American bodies take form exactly as planned and fully meet specifications.

ENGINEERS representing A. C. & B. discuss your requirements at your desk.

ENGINEERS confer over basic plans in designing all American bodies.

ENGINEERS supervise all details at every stage of development.

ENGINEERS oversee the construction of bodies and equipment all the way through the shop.

A C B

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LINE CONSTRUCTION BODIES • MAINTENANCE BODIES • GENERAL SERVICE BODIES
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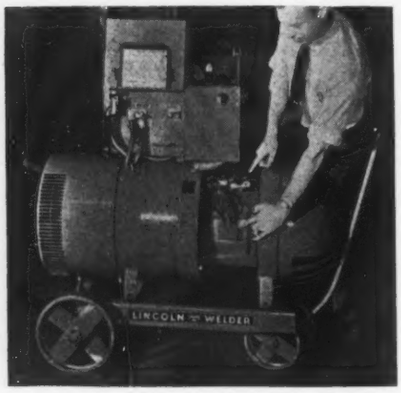
CABLE SPLICING TRAILERS • WINCHES • POWER TAKE-OFFS AND POLE DERRICKS
REELS AND ASSOCIATED EQUIPMENT

Send for illustrated descriptive circulars

NEW EQUIPMENT

Welder Control

New protective control device is designed to protect arc welding machines against heat or excessive current, or both. It has



Protective control device for arc welding machines. **The Lincoln Electric Co.**, Cleveland, Ohio.

two current transformers, the primaries of which are connected in series with the motor leads and the secondaries supplying power to operate two snap-action thermostats which are mounted directly on the motor lamination. Thermostats automatically reset when motor returns to a safe operating temperature or when current is reduced.

•

Galvanizing Compound

Galv-Weld compound. **Galv-Weld, Inc.**, Dayton, Ohio.

Used in connection with a regalvanizing process, galvanizing material permits the welding of galvanized or other sheets and structural metal parts, so that joints are left in rust-proof condition, it is claimed. Welds can be made in usual manner, with standard welding rods. A bar of the galvanizing material is held against the weld while it is still hot enough to melt same.

•

Ground Electrode Box

"No. 22109" ground electrode box; 10 in. diameter, 12 in. deep. **N. Slater Company, Ltd.**, Hamilton, Canada, and **Hubbard & Company**, Pittsburgh, Pa.

A galvanized steel sectional box with lid has been made available for protection against mechanical injury to ground conductors and connectors. It is set over the upper end of the ground rod and connector, permitting periodic inspection and checking for resistance, and grading of soil in the vicinity.

•

Lamp Starter

"999 Power Unit" and lampholder. **National Transformer Corp.**, 224-232 21st Ave., Paterson, N. J.

New multiple-circuit transformer device provides instantaneous starting of two fluorescent lamps without use of customary starter switches, starter sockets and compensators. High overall power factor is provided for the lamp circuit; flicker and radio interference are reduced. Stabilization of lamp life is claimed when this method is used. Lampholders feature shunting arrangement to open circuit when either lamp is removed for replacement.

•

Truck

Combination line construction and tower unit has all-steel body with multiple section sliding roof. It is equipped with a 15,000-lb. single drum winch, a pole der-

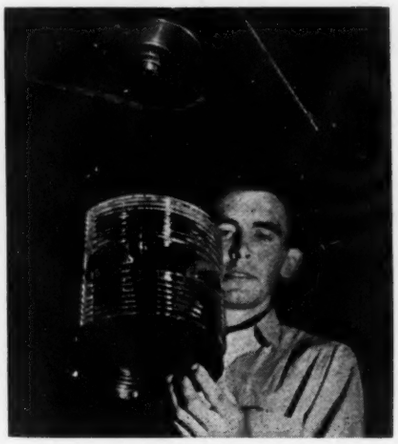
Line construction and tower truck. **The American Coach and Body Co.**, Cleveland, Ohio.

rick and accessories such as ladder racks, pike pole brackets and pintle hook. Two-column tower is operated from truck transmission. Platform measures 48 x 72 in., has folding guard rails and an insulator under each corner, elevates to 19 ft. 7 in. above ground; over-all collapsed height is 9 in.

BUYING ELECTRICAL EQUIPMENT?—McGraw-Hill's *Electrical Buyers Reference* is a convenient place to look first for manufacturers' product data, names and addresses.

Anti-Sabotage Light

New lighting unit for use in protective fence lighting systems uses a Fresnel type heat-resisting lens to produce a wide hori-



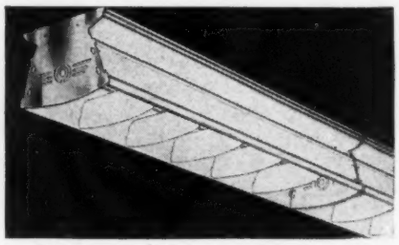
Anti-sabotage light; maximum of 6,000-lumen series or 300-watt multiple lamps. **General Electric Co.**, Schenectady, N. Y.

zontal spread of light and a relatively narrow vertical beam. Reflector of chromium plated copper and lens are assembled into a sheet steel housing. Bracket permits unit to be adjusted in horizontal and vertical planes.

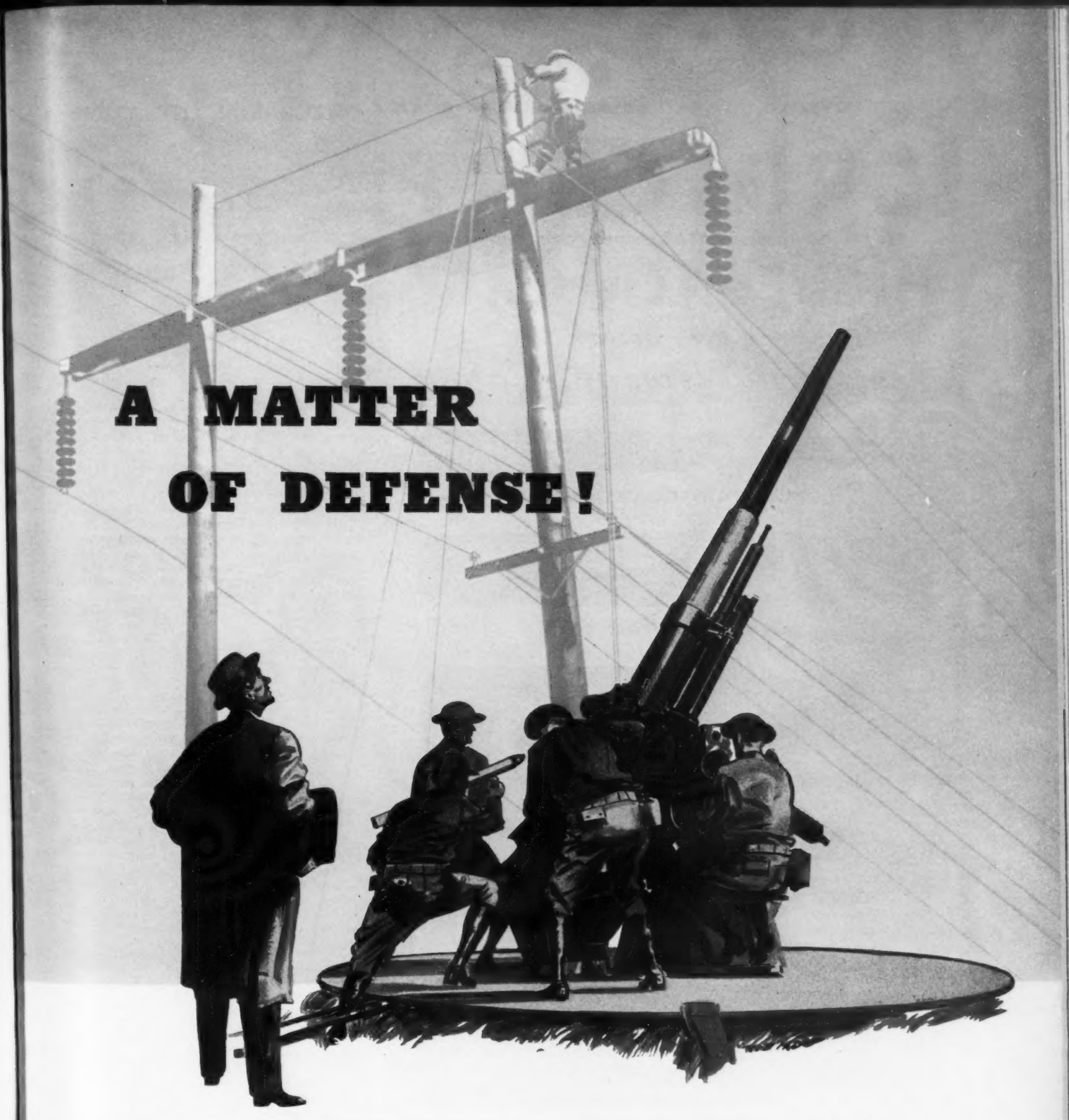
•

Fluorescent Fixture

Louver type exposed troffers for direct ceiling mounting are designed for single unit installations and long continuous runs. Louvers are removable. Fixture body and louvers are finished in "super white" enamel.



Exposed troffer fluorescent fixture; available for one and two 48-in., 40-watt lamps in parallel and for 60-in., 100-watt lamp. **Day-Brite Lighting, Inc.**, 5411 Bulwer Ave., St. Louis, Mo.



Every mile of Pole Line that YOU build is a matter of defense effort. Every watt that flows through your conductors is a contributing factor toward the production of a bomber, a battleship or a field-piece.

These instruments of warfare cannot be produced without power—and power cannot be utilized without electrical transmission and distribution systems built to defy the naturally destructive elements of corrosion, electrical strain from lightning and mechanical strain from wind and sleet.

Whether it is a matter of defense or just good, plain, everyday customer service, it has to be RELIABLE. The engineer who specifies Hubbard Pole Line Hardware for his lines is giving his customers that quality which is an assurance of reliability.

ANG THE DEFENSE LOAD ON HUBBARD HARDWARE!"

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PITTSBURGH, PENNSYLVANIA
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RUBBER COVERED POWER CABLES • BUILDING WIRE

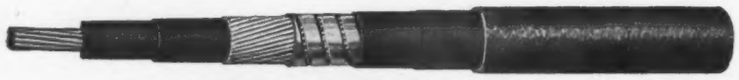
CRESCENT

a name that stands for

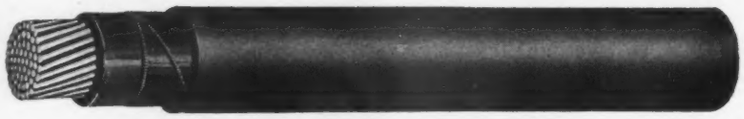
HIGHEST QUALITY

in every type of

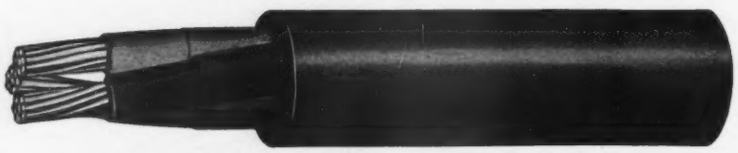
Electrical Wires and Cables



SERVICE ENTRANCE CABLE

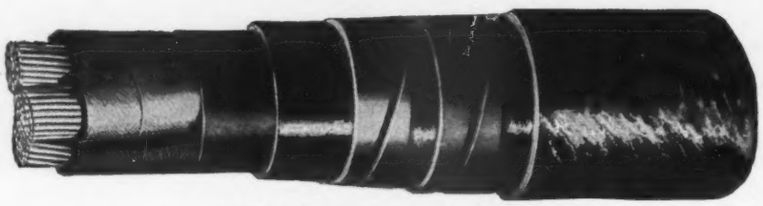


LEAD ENCASED POWER CABLE



IMPERIAL PORTABLE CORDS & CABLE

IMPERIAL WELDING CABLE



PARKWAY AND TRENCH CABLE

CRESCENT INSULATED WIRE & CABLE CO.

CRESCENT

WIRE and CABLE

Factory: TRENTON, N. J.—*Stocks in Principal Cities*

CRESFLEX NON-METALLIC SHEATHED CABLE • SERVICE ENTRANCE CABLE • MAGNET WIRE • BARE WIRE

VARNISHED CAMBRIC • FLEXIBLE CORDS • LEAD ENCASED AND PARKWAY CABLES • ARMORED CABLE

CRESCENT ENDURITE SUPER • AGING INSULATION

TECHNICAL LITERATURE

SMALL DIAMETER WIRE—Designed to serve as a manual and reference for electrical men interested in wiring activities, a 50-page pocket-size handbook covers the use of the new small diameter wire for rewiring of office and factory buildings, in order to increase capacity of the electrical system without the expense of replacing existing raceways, rebuilding and redecorating. Included are descriptions of wire types and their characteristics, calculations of voltage drop, thirteen tables and diagrams of typical distribution systems. "Rewiring for Commercial and Industrial Buildings" is available from Edison Electric Institute, 420 Lexington Ave., New York, N. Y., price 25 cents per single copy.

REPORT ON TELEMETERING, SUPERVISORY CONTROL AND ASSOCIATED CIRCUITS—Characteristics of some 50 systems of telemetering and 13 of supervisory control by 23 manufacturers are reported in full technical detail by a joint subcommittee of the A.I.E.E. committees on automatic stations and instruments and measurements. This supersedes a 1932 report which had limited circulation. It discusses principles and applicability to water, oil, gas and other industries for remote metering, indication or control of levels, pressures, temperatures, flows of liquids, gases, etc. along with monitoring devices that may be electrically actuated. The report is obtainable from American Institute of Electrical Engineers, 33 West 39th Street, New York, at 80 cents (to members at 40 cents).

THERMOCOUPLES—A 32-page book contains recommendations for checking thermocouples and pyrometers, information on how to construct thermocouples, millivolt tables, temperature conversion tables, decimal equivalents, pipe and wire sizes, and resistances of thermocouple and lead wire. In addition, recommendations are given for selection of thermocouples as well as protecting tubes, with respect to various atmospheres, media, maximum temperature, and material of tube. A listing of the company's thermocouples and accessories are included. Copy of the book, "Thermocouple Data Book," Bulletin No. S2-3, is obtainable from Wheelco Instruments Co., Harrison and Peoria Sts., Chicago, Ill.

SPRING ALLOYS—Physical, magnetic, and electrical properties of "Z" nickel, "K" Monel, Monel, Inconel, and malleable nickel are given in an 8-page booklet, "New Spring Alloys," available from The International Nickel Co., Inc., 67 Wall St., New York, N. Y. In addition there are illustrations and actual service records of springs made of the five metals, for conditions involving corrosion and temperature extremes.

VULCANIZED FIBRE—Physical, electrical and mechanical properties of vulcanized fibre, also machining technique for users who are equipped to do their own fabricating, as well as grades, colors and applications of sheet stock, dimensions, colors and tolerances of tubes and rods, are some data included in the "National Fibre Engineers' Handbook," available from National Vulcanized Fibre Co., Wilmington, Del.

SAE STEELS—Chemical compositions of SAE steels, reprinted in large, easily readable type, from 1941 SAE Handbook, are available in a handy card-folder issued by the Babcock & Wilcox Tube Co., Beaver Falls, Pa. Technical Data Card 108A may be obtained by a request on your company letterhead.

NEWS ABOUT PEOPLE

H. S. Pahren Assigned New Duties by Elliott Co.

Announcement has been made of the appointment of H. S. Pahren as manager of the electric power sales department of the Elliott Company, Jeannette, Pa. His headquarters are the Ridgway, Pa., works of the company and his jurisdiction covers the Elliott line of motors, generators and electromagnetic couplings.

Mr. Pahren has had well-rounded training and experience. He went to the University of Cincinnati as the first Westinghouse War Memorial scholar, graduating as electrical engineer. While at the university he was also employed in the electric meter laboratory of the Union Gas & Electric Co.

Following graduation he joined Westinghouse, working at the East Pitts-

burgh, Sharon, Derry and South Philadelphia works. He was then sent to the Cincinnati and later to the Indianapolis office, after which he was transferred to Dayton, Ohio, as sales engineer in the central station division. Subsequently he became electrical engineer in the Department of Public Utilities of the city of Cincinnati. He joined the Elliott Company in 1928 and has been located in the Kansas City, Omaha, Tulsa and St. Louis offices.

Mr. Pahren has served as district manager in St. Louis since 1936.

•

General Electric Names Five Vice-Presidents

Announcement was made this week by Charles E. Wilson, president of the General Electric Co., of the election of five new vice-presidents by the board of directors of the company. The new officers are Walter R. G. Baker, Chester H. Lang, David C. Prince, Elmer D. Spicer and Harry A. Winne.

The new officers were elected in connection with a major change in the company's organization. Under the new set-up the company will have four major operating departments: Appliance and merchandise, under Vice-President Hardage L. Andrews; radio and television, under Vice-President Baker; lamp, under Vice-President Joseph E. Kewley, and the apparatus department, which, because of its great volume of business and diversification of products, will be staffed by five vice-presidents, whose duties will be along functional lines. These vice-presidents are: Mr. Lang, in charge of defense activities and also continuing as manager of apparatus sales; Mr. Prince, in charge of application engineering—apparatus department; Earl O. Shreve, in charge of commercial activities, apparatus department; Mr. Spicer, in charge of manufacturing — apparatus department, and Mr. Winne, in charge of design engineering—apparatus department.

Vice-President William R. Burrows, formerly in charge of general manufacturing operations, and Vice-President Roy C. Muir, formerly in charge of general engineering operations, will become members of the president's staff, carrying out assigned duties in these respective fields.

WITH PLEASURABLE ANTICIPATION—John A. Hooper, formerly assistant superintendent of the plant department, Northwestern Electric Co., Portland, Ore., has recently been made superintendent of stations, succeeding L. A. Morphy, who became assistant superintendent of power for the Pacific Power & Light Co. He is shown in the act of assuming his new duties

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▶ J. W. DURKIN has been appointed Chicago district manager of the Sangamo Electric Co., Springfield, Ill., assuming the duties of the late Cecil Hurtt. Mr. Durkin formerly covered the Kansas City territory for the Sangamo organization. FRANK LOW has been transferred from Cedar Rapids, Iowa, to Kansas City, replacing Mr. Durkin in the Kansas City territory, which he will cover in addition to his Iowa clientele.

▶ GEORGE H. WISTING, assistant general manager of Northwestern Electric Co., Portland, in charge of new business, has been granted a leave of absence by the company to become vice-president and director of the Columbia Aircraft Industries, Inc., a local concern organized to

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SAVING MONEY
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NO. 1
COMPRESSOR

★ SMITH COMPRESSORS are saving money for utility companies, utility construction companies, general contractors the country over. Consider the savings you'll enjoy with their use! BIG savings in purchase cost over standard compressors of equal capacity . . . important savings on upkeep, too! Made with FORD Motors and standard parts—that means dependability and economy. Repairs and parts at Ford garages everywhere. 60 cu. ft. size uses only one gal. of gasoline an hour! Handle all pneumatic tools used by construction companies. Easily portable—tow them from one job to another at permissible truck speeds. No couplings, belt, clutch or gears to wear and cause trouble. Head equipped with high speed compressor valves; automatic unloading and idling.

A utility company in Pittsburgh uses 31 Smith Compressors. Words of praise come from users everywhere. These are typical: "I am very well pleased with my compressor. I believe it is one of the best pieces of equipment I have ever bought." Signed, A. R. Welsch, Contractor, Joliet, Ill.

With a Ford Motor and shop facilities you can assemble your own Smith Compressor. We will furnish a Smith Compressor Head and Accessories with complete instructions for mounting.

Write for free Booklet

GORDON SMITH & CO.
INCORPORATED
495 College St. Bowling Green, Ky.

★ Smith ★
AIR COMPRESSORS

make airplane parts. JOHN C. PLANKINTON, formerly manager of commercial and industrial sales for the Northwestern Electric Co., will assume Mr. Wisting's duties as head of the new-business department.

•

Receive New Assignments in Westinghouse Plant

D. W. R. Morgan, George P. Passmore and A. P. Craig will supervise increased expansion and production activities in the Westinghouse Electric & Manufacturing Co.'s South Philadelphia works.

Mr. Morgan will direct over-all manufacturing operation, both in the South Philadelphia works and the new merchant ship equipment shops. He has been connected with Westinghouse since 1913.

Mr. Passmore takes charge of the industrial relations department, and Mr. Craig, as assistant to vice-president, will be responsible for co-ordinating the work of all company departments in building and equipping the merchant ship factory buildings. Mr. Passmore has been identified with Westinghouse since 1921.

Mr. Craig joined Westinghouse in 1928.

•

▶ WILLIAM S. HILL, general superintendent of the Grays Harbor PUD at Aberdeen, Wash., has been named acting manager, succeeding Robert W. Beck, resigned. H. E. Bailey, PUD commissioner, announcing the appointment, stated that Mr. Hill will serve until some one is selected as manager on a permanent basis.

▶ LIEUT.-COMMANDER CARL E. EGELER, U.S.N.R., an executive engineer at General Electric's Nela Park engineering department, Cleveland, has just been called back to military service after 22 years. He has been assigned to Munhall, Pa., as resident inspector of naval material.

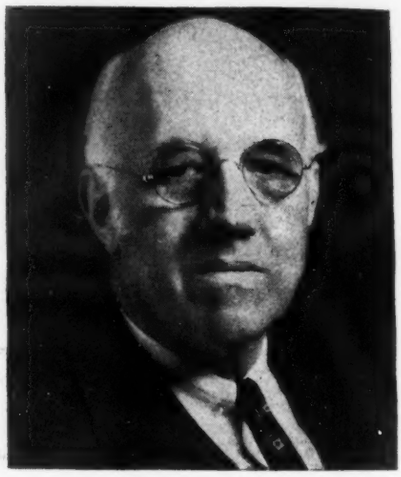
▶ HERBERT A. COHN and WALTER W. WENDELKEN, formerly of the factory service division of the Westinghouse Electric & Manufacturing Co., have been appointed superintendents in the building construction and maintenance department. Mr. Cohn becomes steam superintendent responsible for all boiler plant and heating installations in connection with building projects. Mr. Wendelken as electrical superintendent will supervise electrical design and specifications. Both men will serve all divisions of the company in a consulting capacity.

OBITUARY

Earl Whitehorne

Earl Whitehorne, editor of *Electrical Contracting*, published by the McGraw-Hill Publishing Co., died on October 23 at his home in Caldwell, N. J., at the age of 59 years. Though confined to his home for more than a year, he had continued in an active editorial capacity up to the time of his death.

Mr. Whitehorne was born in Verona, N. J., in 1881. His first venture in the electrical business was when he operated a contracting firm in Newark, N. J., at the age of 20. In 1907 he became a founder and managing editor of *Selling Electricity*, now *Electrical Merchandising*. Subsequently he opened his own advertising business, but continued as a contributor to *Electrical Merchandising*, which had been acquired by McGraw-Hill under the name of *Electrical Merchandise* and expanded into *Electrical Merchandising*. In the meantime he had become a contributing editor on ELECTRICAL WORLD. In 1921 Mr. Whitehorne joined the McGraw-Hill Publishing Co. as commercial editor of ELECTRICAL WORLD and associate editor of *Electrical Merchandising*, and later became also associate editor of *Radio Retailing*. He next was made editorial director of *Electrical Merchandising*, and later of *Radio Retailing* and *Wholesaler's Salesman*. In 1936 he became editor of *Electrical Contracting*.



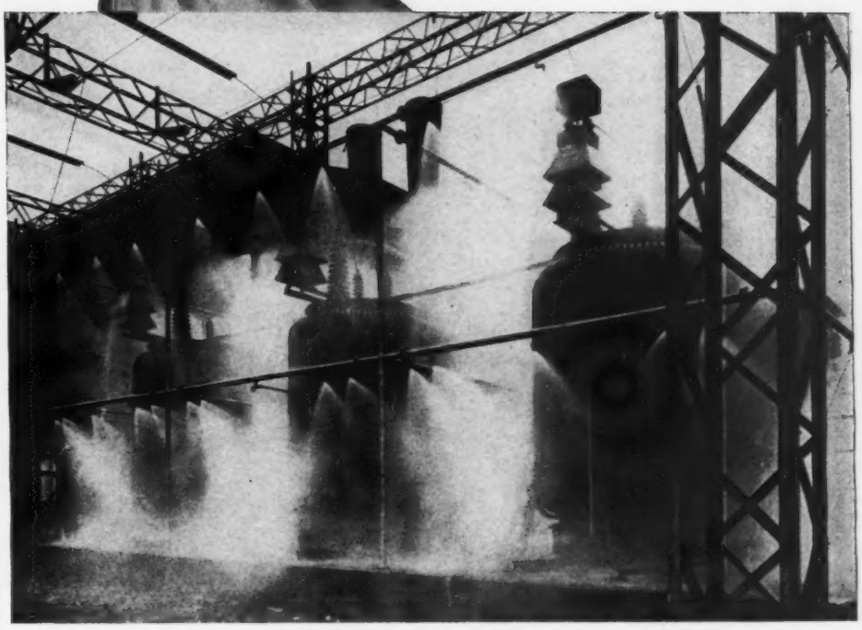
For the past fifteen years Mr. Whitehorne had participated in the selection of men in the electrical field for the James H. McGraw Awards. He headed the well-known "Industry Conference on Wiring" in 1926, that showed up the fallacy of the controversy then raging over the cost of wiring. He was a past-president of the Electrical Association of New York and a former director of the American Management Association.

▶ THEODORE STEBBINS of Miami, Fla., a former consultant engineer, died on October 14 in the Doctors Hospital, New York, after a brief illness. He was 76 years of age. Mr. Stebbins was born in Omaha and was graduated from the Massachusetts Institute of Technology in 1886. He was with the General Electric Co. in Schenectady before he became a consultant engineer. Mr. Stebbins was a fellow and life member of the American Institute of Electrical Engineers and a member of the A.S.M.E.

▶ HARRY N. CARROLL, manager of commercial and industrial electric sales for Pacific Gas & Electric Co., died suddenly, in San Francisco on October 23, from a heart attack. Born in Carthage, Mo., in 1886, Mr. Carroll was a graduate of the Missouri School of Mines. Following several years of general mining experience in the Middle West, he went to South America in 1919 for the International Petroleum Co. as an engineer on pipeline construction work in Colombia. Mr. Carroll joined San Joaquin Light & Power Corp. in Fresno, Calif., in 1923 as an industrial power salesman. In 1927 he became sales manager of Great Western Power Co. and a short time later division manager for the company in San Francisco, a position he occupied when Great Western was merged with P.G.&E. Since that time he held various executive positions in the company's sales department. Mr. Carroll was a past-president of the San Francisco Electric Club and was a former chairman of the business development section of the Pacific Coast Electrical Association. At the time of his death he was chairman of the PCEA industry information committee.

▶ HERBERT A. EHRMANN, of the tax department of Consolidated Edison Co. of New York, died October 16 at Doctors Hospital, New York, after an illness of several weeks. Mr. Ehrmann had been actively engaged in the public utilities business for more than thirty years. He went to work with the Peoples Gas Light & Coke Co. of Chicago in 1907. Fifteen years later he became assistant controller and then treasurer of the Midland United Co. and the Midland Utilities Co. He also held the position of treasurer of the West Ohio Gas Co. and of the Chicago, South Shore & South Bend Railroad. In 1934 Mr. Ehrmann became assistant to the secretary of Consolidated Gas Co., now Consolidated Edison Co. of New York, and in 1937 was placed in charge of social security taxes in the tax department of the company. He had been chairman of the accounting section of the American Gas Association and a director of the Controllers Institute of America.

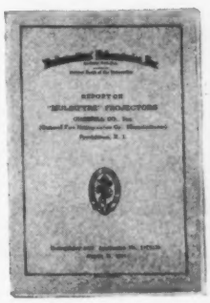
Driving Water-Spray smothers oil fires FAST!



Unique Mulsifyre Systems churn blazing oil into Non-Flammable Emulsion!

Before major fire-damage can occur in transformers, turbines or other oil-bearing equipment, a Mulsifyre System will quench blazing oil with fine, high-velocity sprays of water alone! There's nothing to harm equipment or unburned oil.

Mulsifyre Systems are fixed equipment . . . the only protection operating on the *mulsifying* principle. When fire starts, high-pressure water is admitted to the system either manually or automatically. Instantly, driving sprays from patented Mulsifyre Nozzles strike the oil . . . churn it into a non-flammable emulsion . . . stop fire within 2 to 5 seconds!



WRITE FOR this 76-page booklet by Underwriters' Laboratories explaining Mulsifyre Systems in detail.

Get full information on this outstanding development. Now approved and widely installed by leading utility companies. Grinnell Co., Inc., Executive Offices, Providence, Rhode Island. Branch offices in principal cities.

GRINNELL

Automatic Sprinkler Fire Protection

MANUFACTURING-MARKETS

Westinghouse Orders Advance 72 Percent

Reporting on operations in the first nine months of the current year, A. W. Robertson, chairman of the Westinghouse Electric & Manufacturing Co., informed stockholders that orders booked during the period reached a high record of $450,242,292, an increase of 72 per cent over the similar period of 1940.

Despite an increase of 356 per cent in taxes over the corresponding nine months of last year, the net income for the first three quarters of 1941 amounted to $15,860,252, an increase of 9 per cent over the $14,583,327 net income reported for the first nine months of 1940.

After allowing for dividend requirements on the preferred stock, this year's net is equivalent to $5.94 a share on the 2,592,155 shares of common stock, against $5.46 a common share for the 1940 period. Provision for the federal normal tax and excess profits taxes amounted to $29,442,045, so that the earnings before federal taxes came to $45,302,297, or 115 percent above the corresponding figure a year ago.

Sales billed by the company during the first nine months of this year were $269,709,773, an increase of 54 percent, and unfilled orders for the same period increased 160 percent to $394,861,959.

"The financial outlook is excellent," Mr. Robertson said. "Since the national defense program began we have doubled our output. Despite this, our backlog of unfilled orders represents a year's work at our present rate of production. Employment is at an all-time peak of 75,000, a gain of more than 25,000 since the summer of 1940. . . ."

•

Vacuum Cleaner Sales Up

Sales of vacuum cleaners during the month of September amounted to 215,789 units, compared with 138,923 units for the similar month of 1940, according to an announcement by the Vacuum Cleaner Manufacturers Association. July sales, formerly reported at 182,324 units, have been revised to 187,820.

•

York Ice Forms New Sales Department

In line with the current defense trend to "repair rather than replace" industrial and commercial equipment and also to maintain close contact with regular customers during the present emergency, the York Ice Machinery Corp. has organized a new sales department known as the accessory equipment and maintenance department.

To head this recently organized department the management has selected J. L. Rosenmiller, who organized York's oil and cold storage door business and managed its sales promotion division. The new department includes all the personnel of the former service department and the former accessory equipment and supplies division.

The advertising department of the company has left its former quarters in New York City and is now combined with the sales promotion department of the company at factory headquarters in York, Pa. Anker Winther, assistant general sales manager of the corporation, will supervise the activities of the new advertising and sales promotion department.

•

Raise Zinc Scrap Prices

Leon Henderson, federal price administrator, has revised upward the prices of zinc scrap and secondary slab zinc and changed the pricing system from a "delivered" to a "shipping point" basis to afford an equal opportunity for all manufacturers to compete for supplies. The upward revision reflected the recent increase of 1 cent a pound allowed in primary zinc prices.

Manufacturers Issue Nine-Month Reports

For the nine months to September 30 Square D Company reports net profit of $2,255,876, after $4,410,775 reserve for federal income and excess profits taxes, equal, after dividend requirements on 5 percent preferred stock, to $5.17 each on 421,360 shares of common stock. This compares with net profit for the similar period of last year of $1,263,002, or $2.82 a common share.

Among the other companies reporting September quarter or nine months operations are the following:

ANACONDA WIRE & CABLE—Nine months to September 30, net income, preliminary, $2,146,580, equal to $5.09 a share on 421,981 common shares, compared with $917,845, or $2.18 a share last year.

BABCOCK & WILCOX—Including wholly owned subsidiaries, nine months to September 30, net profit, $3,095,576, after $6,618,000 provisions for Federal income and excess profits taxes. Net is equal to $4.60 each on 671,970 shares of capital stock. This compares with $1,832,266, or $2.72 a share, last year, when provision for Federal taxes was $1,311,500. Company's equity in estimated profits, less losses, of companies more than 50 per cent, but not wholly owned, less dividends declared, amounted to $563,015 in 1941 period, against $495,762, in 1940.

BLAW-KNOX—September quarter, consolidated net profit after $625,284 Federal income and excess profits taxes and $250,000 provision for contingencies, $397,670, equal to 30 cents each on 1,334,358 shares of capital stock. Profit before provision for contingencies was $647,670, or 48 cents a share. This compares with an indicated net profit of $635,643, equal to 47 cents share, in preceding quarter, and with $584,853, or 44 cents a share in first quarter of this year. Nine months to September 30: net profit, $1,618,166, equal to $1.21 a share, compared with $891,952, or 67 cents a share, last year. Unfilled orders on September 30 last approximated $27,000,000, an increase of about $4,000,000 since June 30.

•

Will Get Pay Increase

Approximately 2,300 employees of the General Cable Corp., Rome, N. Y., will receive a wage increase of 6 cents

an hour under a new one-year contract between the company and the General Cable Guild, an independent union.

•

Manufacturers Make Sales Appointments

Among the recent assignments made by manufacturing companies to their sales staffs are the following:

Bailey Meter Co., Cleveland, announces the appointment of R. M. Cundiff as manager of its Cincinnati branch office at 2512 Carew Tower Building. He succeeds E. R. Dearborn, resigned. For the past twelve years Mr. Cundiff has been located in the company's New York branch office, where he has devoted his efforts to the application of metering and control equipment to steam power plants and industrial processes.

W. B. Simons, Charlotte, N. C., has been appointed representative for Cochrane flow meters in the Carolinas, the Cochrane Corp., Philadelphia, has announced.

Carl W. Millsom, Jr., has been appointed to the position of Airtemp district manager for western New York state, with headquarters in Jamestown, N. Y. Mr. Millsom takes over the duties of William Dennison, who has been advanced to the position of regional manager of Texas. William R. Groves has been appointed a district manager of Airtemp division, with headquarters in Atlanta, Ga. Mr. Groves was recently associated with the Westinghouse Electric & Manufacturing Co. in the merchandising division.

•

General Electric Makes Turbine Group Changes

Consolidation of the mechanical drive and turbine-generator sections at General Electric's Lynn River works has been announced by C. S. Coggeshall, manager of the company's turbine division. J. L. Kerr has been named manager of sales of the consolidated Lynn section, with L. D. Whitescarver, formerly a turbine specialist in the company's Atlantic district, as general assistant.

All of the company's business in land and marine turbines rated at 7,500 kw. and less will be handled through the Lynn section, as well as mechanical drive turbines and generator sets of 400 kw. and less.

New York Metal Prices

	Oct. 28,'41 Cents per Pound	Oct. 22,'41 Cents per Pound
Copper electrolytic	12.00*	12.00*
Lead, A. S. & R. Price	5.85	5.85
Antimony	14.00	14.00
Nickel, Ingot	35.00	35.00
Zinc Spot	8.64	8.64
Tin, Straits	52.00	52.00
Aluminum, 99 percent	15.00	15.00

* Delivery Connecticut Valley.

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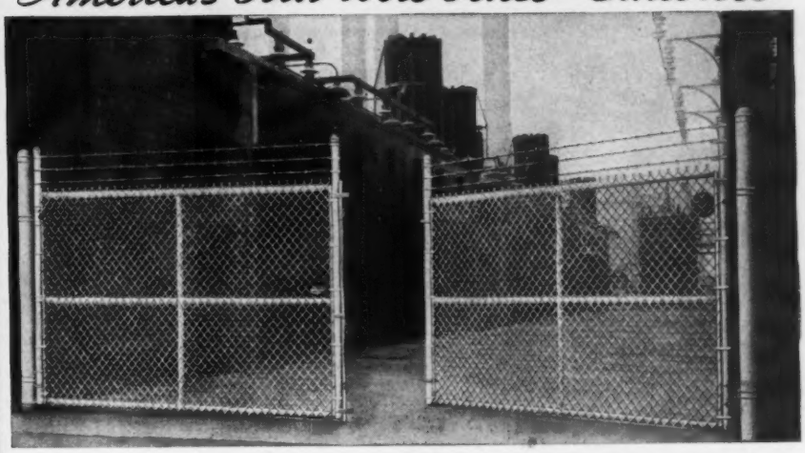

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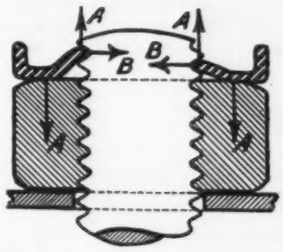

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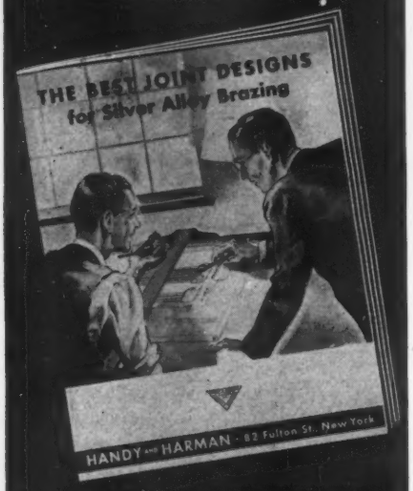

This new bulletin gives practical information and data telling how good joint designs can help you speed-up production, in making strong, leak-tight joints with the low temperature brazing alloys . . .

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Field Reports on Business

Business continues to operate at an extremely high rate, although output gains of the usual seasonal magnitude have failed to materialize in some lines. Under the impetus of defense requirements industrial plant expansion continues at a rapid pace. Appliance retail business is good.

NEW ENGLAND

Considerable activity in projects for increasing utility generating capacity in this area is reported. OPM orders for a wide variety of electrical equipment continue to be placed in large installments among industries here, with little likelihood of any abatement in the trend during the remainder of the year.

A 7,500-kva. transformer was bought last week by an industrial plant. Sales of motor pumping units stimulated by the drought and the defense program are in good volume and the demand for controller indicators, cable, small switches, line materials and geared head motors keeps up at a steady pace. Government purchases recently announced include gear motors and control equipment from Westinghouse, amounting to $26,840; magnetos, totaling $59,000, and maintenance parts, amounting to $230,713, American Bosch Corp., Springfield, Mass.; switchboards, $33,630, headsets and receivers, Connecticut Tel. & Tel. Co., Meriden, Conn., $35,103; tubes, Hytron Corp., Salem, Mass., $17,303; switching apparatus, amounting to $29,944, to be manufactured at Worcester, Mass., under order of A. J. Ulmer Co., New York, and headsets, Wm. J. Murdock Co., Chelsea, Mass., $117,859.

Hanson-Whitney Machine Co., Hartford, Conn., has concluded a lease-agreement with the DFC for construction of an addition to its plant at a cost of $325,000. The Navy Department has awarded a contract for airplanes and spare parts amounting to $2,439,968 to Vought-Sikorsky Aircraft Division, United Aircraft Corp. Ensign-Bickford Co., Simbury, Conn., has received a contract for primacords and fuses aggregating $122,280.

CHICAGO

One of the most important developments regarding defense activities in this area last week was the Defense Clinic, in which nearly 5,000 small business representatives met with 150 prime contractors. As a result of this effort to reduce "priorities shutdowns" by spreading contracts among smaller firms, approximately 1,800 subcontracts were set in motion for completion within the next six months. Hundreds of thousands of dollars worth of orders were lined up for potential sub-contractors, which will undoubtedly save many small manufacturers in the Middle West from closing their plants.

Industrial plant expansions in this area are continuing at a rapid pace under the impetus of defense requirements. To date this year 481 firms have authorized expenditures totaling $220,491,859, compared with 301 plant additions costing $81,152,600 in the same period last year. In addition the Carnegie-Illinois Steel Corp. announced it will immediately increase facilities at the Gary, Ind., works at a cost of $15,000,000. Fairbanks, Morse & Co. will expand its Beloit, Wis., plant at a cost of $5,500,000.

Defense contracts awarded in this area last week nearly doubled the amount in the previous week. Orders for electrical equipment included: American Automatic Electric Sales, handsets, receivers and transmitter units, $699,849; Kellogg Switchboard & Supply Co., switchboards, $580,280; American Phenolic Co., cable, $140,200; Leich Electric Co., switchboards, $30,701; Webster Electric Co., solenoids, $98,890; Burgess Battery Co., batteries, $31,498; Nehring Electrical Works, conductors, $27,575; Grimes Manufacturing Co., lamp assemblies, $922,531.

NEW YORK

Current reports indicate continued progress in preparations for defense. The developments of recent weeks have emphasized, however, the extent to which the defense program, while stimulating activity in some branches of industry, is restricting operations in others.

Donald M. Nelson, head of the priorities division of OPM, early this week ordered a 35 percent cut in steel consumption by the domestic non-mechanical ice refrigerator industry for the period between September 1 and December 31. Mr. Nelson said that tentative plans have been made to hold steel consumption by the industry at the reduced level through August 31, 1942.

Small-size boxes will be the types chiefly eliminated in the 1942 lines of electric refrigerators, distributors reported this week. Wholesale demand for table and boudoir lamps has slowed down considerably in the last two weeks, although in many cases it still exceeds the ability of manufacturers to meet it, producers stated. Retailers feel that holiday business, once it starts, will justify their heavy inventories.

Sales of department stores in the metropolitan district showed a decline of 6 percent for the week ended October 25, in comparison with the same week last year, according to the preliminary report issued by the Federal Reserve Bank of New York.

PACIFIC COAST

Wholesalers report a continued marked decrease in the number and size of defense projects offered for bidding, but their orders hold up because much previous construction is now in electrical stage.

New industrial developments cover a projected $1,500,000 welding plant at San Carlos on Bay Peninsula; a $1,000,000 Union Carbide plant near St. Johns, Ore., and a 77,000-ton ingot increase to Columbia Steel plant at Pittsburg on Upper San Francisco Bay.

Several large awards are reported, including $616,800 to Allis-Chalmers for turbine and governor for Shasta plant; $975,800 to General Electric for three 25,000-kva. generators for Keswick plant; $184,880 for steam generator unit for city of Glendale, Calif., and $885,294 to Phelps-Dodge for line No. 2 connecting Bonneville and Grand Coulee plants. Electric crane business will be exceptionally heavy, with sixteen bridge cranes costing $340,000 scheduled for Mare Island, and $520,000 of various styles for Terminal Island, Los Angeles harbor.

Manufacturers report a series of well-attended industry meetings on fluorescent lighting and many privately owned installations running from $5,000 to $15,000.

System Protection Study Precedes Oswego Design

[*Continued from page 60*]

operation. It was found that with two units in operation and the 115-kv. neutral grounded at Oswego the fault currents would be increased by from 200 to 300 percent, and these values would approach, if not exceed, the capacity of some breakers in service on the system.

The greater ground fault currents with two units in operation could also cause interference with the communication system, and to some extent affect stable operation. With the omission of the ground at Oswego the fault values for the rest of the system are more uniform under the various possible operating conditions. This simplifies the setting of the ground relays and also allows the automatic oscillograph at Teall Avenue substation to be used more effectively for determining fault location on the 115-kv. system.

Consideration of all the above factors led to the decision not to ground the 115-kv. system at Oswego.

After having agreed that operation and protection were both served better by arrangement No. 5 than by No. 4, the relay engineering department made about 25 three-phase fault studies (each requiring about three-man-days) and as many more line-to-ground fault studies (each requiring twelve man-days) for all likely operating conditions of lines. Ground fault studies required considerably more time, because the zero-sequence-system network could not be set up on the calculating board, due to peculiar mutual couplings between the circuits, and had to be calculated. Relay settings over the system will be based on the results of these studies. Analysis of such a mass of data and the determination of satisfactory relay settings to best fit the various operating conditions also required considerable time. The type of relays chosen for the 115- and 33-kv. lines at the Oswego steam plant are shown symbolically in Fig. 6.

Studies Repeated

Since these studies were made for one 80,000-kw. turbo-generator at Oswego, they have had to be repeated for the condition of two 80,000-kw. turbo-generators at Oswego. The second set of studies showed that a second 115-kv. line was required between the steam plant and Lighthouse Hill, and that the Varick tie between the 115-kv. and 33-kv. systems should be omitted.

Values given in the table and shown on Fig. 5 are taken from the first set of studies with only one 80,000-kw. generator and one Oswego to Lighthouse Hill 115-kv. line.

The relay studies also showed that the reactances selected by the manufacturer for the most economical designs for the alternators and the 13.2/115-kv. transformers were satisfactory for voltage regulation and fault performance.

Incidentally, it should be stated that, with all the fault analyses, there were coincident load-division studies made on the board to make reasonably sure that under all likely conditions of operation the loads between given points would be properly divided between lines. Practically all of the individual lines are good for 120,000 kva. in emergencies from the heating standpoint. All of the alternatives kept the line loadings well within this limit.

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Recent Rate Changes

EDISON LIGHT & POWER CO's voluntary rate reduction of $205,000 has been accepted by the Pennsylvania Public Utility Commission. The utility serves York. The commission served notice the voluntary reduction would have no effect on the commission's directed cut of $397,000. The commission also announced that the Glen Rock Power & Light Co., an Edison affiliate, will also reduce its rate charges in the amount of $32,100, which offer was made at the same time as that of the Edison company. The commission reported it had refused the petition of the Edison company to reopen its record in the rate case against the utility to allow further evidence and testimony. There was nothing in the present situation, the commission said, warranting reopening the proceedings. The company had asked to submit further evidence with respect to prices of labor and material in protesting the commission's ordered $397,000 rate cut. The order was to become effective last month, but both the company and the Utility Consumers League of York filed objections.

SOUTHERN UTAH POWER CO. has been authorized by the state public service commission to institute lower residential and commercial rates which will save its customers in Iron and Washington counties an estimated $12,400 a year. Included in the new commercial schedule will be a "power factor" identical with that allowed by the commission in the new Utah Power & Light Co. schedule.

INLAND UTILITIES CO. power rate charges at Grants, N. M., have been reduced, effective November 1. The rate reduction, the first accomplished by the new commission, is expected to save consumers some $2,500 a year and will affect about 75 per cent of the utilities' customers in that area.

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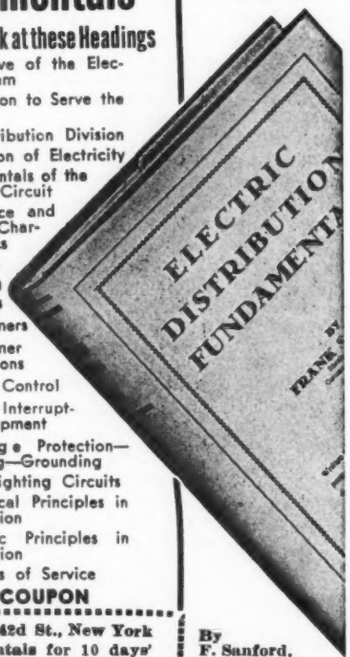

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Balancing Parallel Transformers

[*Continued from page 51*]

wound on the other phase or phases, thus keeping the compensation per phase approximately equal. If the load is at or near full load the work may be completed directly. If the load is at a lower value additional turns must be added, according to a factor readily obtainable from the magnetization curve of the reactor steel. When more than two transformers are involved the transformer carrying the last share of the load should be used as a reference and the load on each of the remaining units adjusted in turn.

The accompanying table shows the results obtainable when using two 100-kva. transformers A and B. A having a 3 percent impedance and B a 5 percent impedance, a rather extreme example. Thus, if the transformers are balanced at 100 percent load the former unbalance of over 14 percent is eliminated. At 125 percent load the error after balancing is less than 3 percent, compared with 18 percent before balancing. At 50 percent load the improvement is not so marked, but at this load perfect balance is of no consequence. With smaller size transformers or transformers in closer original balance the departure from perfect compensation will be less.

Kva. Carried by Transformers Before and After Balancing

A	B (Before Balancing)	B (After Balancing)
0	0	0
50	42.8	54.5
100	85.7	100
125	107.0	122.2

Before proceeding to balance transformers care must be taken to ascertain that the unbalance is not caused by poor connections or other defects. With normal impedance transformers of 50 kva. or larger the secondary current is sufficiently high that connections having only slightly abnormal resistance will seriously affect the load division. Early in the application of the load-balancing set a number of cases of poorly soldered lugs, poor terminal board connections and loosely bolted connections were found which might otherwise have remained unnoticed for many years.

Sales Opportunities

NAMPA, IDAHO—Amalgamated Sugar Co., Ogden, Utah, plans installation of transformers, switchgear and other power substation apparatus; motors and controls, industrial lighting system, regulators, conveyors and other equipment in new beet sugar mill at Nampa, consisting of several large one and multi-story processing and production units, with group of auxiliary buildings. A steam power house is planned. All mill equipment will be electric-operated. Plant will have a capacity for handling about 2,000 tons of sugar beets per day and is estimated to cost approximately $2,000,000. Completion is scheduled in October, 1942.

ELLICOTTVILLE, N. Y.—Niagara, Lockport & Ontario Power Co., Buffalo, N. Y., plans new transmission line from Little Valley to Ellicottville, by way of North Valley. Company will furnish service at Ellicottville effective January 1, 1942, and will construct terminal power substation at that place for step-down voltage for distribution. Ellicottville Electric Light Co. has been supplying local service since 1905, and will close down its station effective with use of central station power at time noted.

BATON ROUGE, LA.—Solvay Process Co., 40 Rector Street, New York, N. Y., manufacturer of industrial chemicals, plans installation of motors and controls, switchgear, duct lines, transformers and accessories, conveyors and other equipment in connection with expansion in branch plant at Baton Rouge, for increased production of soda ash. Work will comprise several large one and multi-story buildings, and will require about 12 months for completion. Cost reported close to $5,000,000. Company is a subsidiary of Allied Chemical & Dye Corp., 61 Broadway, New York.

TERRELL, TEX.—Board of City Commissioners, P. I. Austin, manager, Light Department, plans expansion and improvements in municipal power plant, including installation of equipment for increased capacity. Albert C. Moore & Co., Smith-Young Tower Building, San Antonio, Tex., are consulting engineers.

NEW YORK, N. Y.—Department of Hospitals, 125 Worth Street, is considering plans for extensions and improvements in power plant at institution on Welfare Island, with installation of equipment for increased capacity. Cost reported over $250,000, including equipment.

REDDING, CALIF.—Bureau of Reclamation, Denver, Colo., receives bids until November 12 for three 25,000-kva., 60-cycle, three-phase, three-winding, oil-immersed, water-cooled or forced-oil-cooled outdoor-type transformers, one unit 132,800/230,000 Y volts, another unit 66,400/115,000 Y volts, and third unit 6,800 delta volts, with load-ratio control in intermediate voltage windings, for Keswick hydroelectric power plant, Central Valley project, Calif. Equipment will be installed by government (Specifications 1008).

RENWICK, IOWA—Municipal Light and Power Department receives bids until November 17 for extensions and improvements in municipal power plant, including installation of new Diesel engine-driven generating unit and auxiliary equipment. Ralph W. Gearhart, 349 Twenty-first Street, S.E., Cedar Rapids, Iowa, is consulting engineer.

CLEAR LAKE, WIS.—Wisconsin Hydro-Electric Co., Amery, Wis., has plans maturing for new generating station for standby service at Clear Lake, with installation of a 1,200-kw. Diesel engine-driven generating unit and accessory equipment. Cost close to $150,000. Permission has been secured and work will be carried out soon.

CENTERVILLE, WASH.—Klickitat County Public Utility District, Goldendale, Wash., receives bids until November 14 for power substation near Centerville; also, for transmission line from The Dalles, Ore., to Warwick, Wash., for power supply for rural electric system, for which bids for a number of secondary lines will be received at same time. Colville Engineering Co., Colville, Wash., is consulting engineer.

LOS ANGELES, CALIF.—Hughes Aircraft Co., Jefferson Street and Centinela Boulevard, Mar Vista district, manufacturer of airplanes and parts, has approved plans for new electric-generating station for service at plant and will begin work soon. H. L. Gogerty, 1717 North Vine Street, Hollywood, Calif., is architect.

LOS ANGELES, CALIF.—United States Engineer Office, 751 South Figueroa Street, receives bids until November 17 for one gasoline-electric standby unit, with switchboard and accessories, for installation at Santa Fe dam, Los Angeles County (Invitation 101).

SOUTH POINT, OHIO—Atmospheric Nitrogen Co., Inc., an interest of Allied Chemical & Dye Corp., 61 Broadway, New York, N. Y., plans installation of motor-generator set, motors and controls, transformers and accessories, switchgear, exterior and interior lighting systems, duct lines, conveyors and other equipment in new plant at South Point (Lawrence County), for production of synthetic ammonia and ammonium nitrate for government. It will consist of large group of one and multi-story processing and production units, with auxiliary structures. A steam power house is planned. Entire project is estimated to cost approximately $20,000,000, and financing will be provided in that amount by Defense Plant Corporation, Washington, D. C., a federal agency.

CLEVELAND, OHIO—Cleveland Electric Illuminating Co. has taken out permit for new power substation, 45 x 113 feet, at 9728 Buckeye Road, and will carry out erection at once. Cost close to $70,000, with equipment.

•

Urge New St. Mary Plant

Construction of a hydro-electric power plant and a new lock on the St. Mary's River in Michigan for defense was recently urged by the Army Engineers. The power plant, which would replace an old plant at Sault Ste. Marie, was estimated to cost $10,000,000 at a hearing before the rivers and harbors committee.

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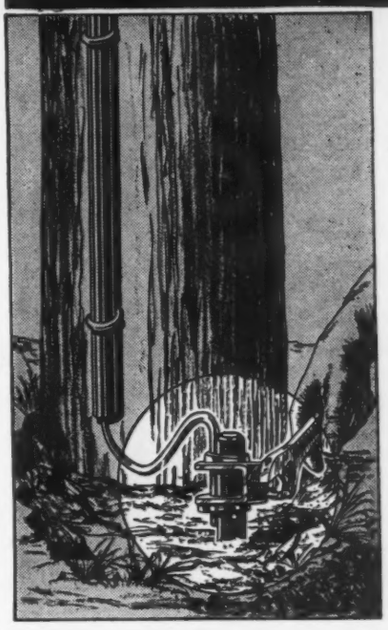

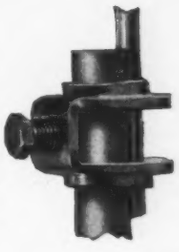

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The first low price efficiently designed Ground Rod Clamp still offers a fine thread screw to apply a really high pressure joint, Everdur material throughout, and a body that springs slightly under stress so it will not vibrate loose. Hollow head set screws when specified.

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Recent Allotments Announced by REA

Harry Slattery, Administrator of Rural Electrification, recently announced allotments totaling $9,271,000 for 40 power systems in 23 states, including new power cooperatives in Minnesota and Mississippi and a small generating plant in Wisconsin, four new cooperative distribution systems in New York, others in New Mexico, Colorado and South Dakota, and additions to existing systems in 20 states.

This brings REA allotments since it was created to $415,648,821, of which $46,821,200 has been allotted during the current fiscal year.

Construction of all of these new electrification systems must depend, of course, upon the availability of materials in accordance with the regulations of the government agencies concerned with supplies for national defense. In this connection, Administrator Slattery recently said, in a magazine article, "application for direct defense uses must receive absolute priority. Shortages have developed and will develop. Our line-construction program will be curtailed. If any copper is available after munitions needs are met, REA will get it. But we can have no hesitancy in deciding when we must choose between farm electric lines and shell cases."

Among the new allotments are the following:

COLORADO—Mountain View Electric Assn., Inc., Colorado Springs, George H. Spaulding, pres., $481,000 to build 591 miles of line, 982 members in Douglas, El Paso, Pueblo and Elbert counties.

MINNESOTA—Western Minnesota Power Cooperative, Benson, E. L. Smith, president, $1,500,000 for the construction of generating facilities.

MISSISSIPPI—South Mississippi Electric Power Assn., Collins, O. L. Watson, president, $2,100,000 for transmission lines and generating facilities.

MISSOURI—Southwest Electric Cooperative, Bolivar, L. L. Alexander, supt., $300,000 to build 320 miles of line, 796 members in Webster, Polk, Dallas, Greene, Hickory, Benton and Camden counties.

NEW MEXICO—Mora-San Miguel Electric Cooperative, Inc., Mora, B. L. Betteshill, president, $177,000 to build and acquire 173 miles of line, 615 members in Mora and San Miguel counties.

NEW YORK — Steuben Electric Assn., Inc., Bath, Arthur M. Seaman, president, $664,000 to build 712 miles of line, 1,732 members in Steuben and Schuyler counties. Otsego Electric Assn., Inc., Oneonta, Alfred Monson, president, $432,000 to build 442 miles of line, 1,128 members in Otsego, Madison and Herkimer counties.

NORTH DAKOTA—Nodak Rural Electric Cooperative, Inc., Grand Forks, James F. Coleman, supt., $566,000 to build and acquire 845 miles of line, 1,766 members in Pembina, Welsh, Grand Forks, Traill, Cavalier, Nelson, Steele and Ramsey counties.

SOUTH DAKOTA—Lincoln-Union Electric Company, Alcester, Virgil T. Hanlon, supt., $232,000 to build 324 miles of line, 631 members in Lincoln, Turner and Union counties.

WISCONSIN—Oconto Electric Cooperative, Oconto Falls, Earl G. Redman, supt., $200,000 for generating facilities.

Early this month announcement was made of an allotment of $2,000,000 for a cooperative generation and transmission system in eastern Kentucky. This system will be built and operated by a group of twelve REA-financed distribution cooperatives in the area. It will be a steam plant of 15,000 kw. initial capacity.

The distribution cooperatives have banded themselves together into the East Kentucky Rural Electric Cooperative. Present headquarters are in Danville, but the exact location of the plant cannot be determined until after exhaustive engineering studies have been completed.

Allotments made earlier in October include the following:

ARKANSAS—Kamo Electric Cooperative, Inc., Vinita, E. H. Looney, chairman, $1,542,000 for the construction of transmission lines.

GEORGIA—The Carroll Electric Membership Corp., Carrollton, W. G. Foster, supt., $158,000 to build 164 miles of line, 606 members in Carroll, Heard, Haralson, Polk and Paulding counties.

ILLINOIS—Coles-Moultrie Electric Cooperative, Mattoon, John G. Waggoner, supt., $252,000 to build 247 miles of line, 703 members in Coles, Macon, Cumberland, Douglas, Moultrie and Piatt counties.

MINNESOTA—Nobles Cooperative Electric, Worthington, William N. McCarville, supt., $230,000 to build 277 miles of line, 557 members in Nobles, Jackson and Murray counties.

MONTANA—Vigilante Electric Cooperative, Inc., Twin Bridges, Howard Babcock, supt., $220,000 to build 246 miles of line, 600 members in Beaverhead, Deer Lodge, Silver Bow, Broadwater, Madison and Jefferson counties.

NORTH CAROLINA—Blue Ridge Electric Membership Corp., Lenoir, G. F. Messick, supt., $316,000 to build and acquire 271 miles of line, 1,571 members in Avery, Caldwell, Ashe, Watauga, Alleghany and Alexander counties. French Broad Electric Membership Corp., Marshall, Mark W. Bennett, supt., $235,000 to build 224 miles of line, 1,092 members in Madison, Yancey and Buncombe counties.

OHIO—Buckeye Rural Electric Cooperative, Inc., Gallipolis, John R. Lusher, supt., $250,000 for construction of a generating plant.

OKLAHOMA—Cotton Electric Cooperative, Walters, C. W. Cox, supt., $120,000 to build and acquire 260 miles of line, 1,111 members in Cotton, Tillman, Jefferson, Stephens and Comancho counties.

OREGON—Benton-Lincoln Electric Cooperative, Inc., Corvallis, Guy Thomas, supt., $465,000 to build 413 miles of line, 900 members in Benton, Lane, Linn and Polk counties.

WYOMING—Rural Electric Company, Pine Bluffs, George N. Phillips, supt., $578,000 to build 703.80 miles of line, 896 members in Kimball, Banner, Morrill, Garden, Deuel and Cheyenne counties, Nebraska, and Logan County, Colorado. Carbon Power and Light Company, Saratoga, Elton Trowbridge, president, $314,000 to build and acquire 240.6 miles of line, 830 members in Carbon county.

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For Public Utilities is provided by Premax Metal Markers and Tags. Easy to install —no upkeep—last as long as the poles.

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• ELECTRICAL • BUYERS REFERENCE
330 West 42nd Street, N. Y. City

Broadened Approach to Residential Lighting

[*Continued from page 61*]

for sketching in room arrangement and lamp recommendations. The pages also show lamps and fixture types peculiar to the room, space to show the additional wattage created by additional lamps, approximate hours used per month and the kilowatt-hour cost. They also allow the salesperson to list materials, key numerals to correspond with arrangement suggestions and approximate cost. The booklet ends with an appeal for low-cost porch lighting.

Much of the salesman's responsibility rests with low-income customers. Here it is impractical to suggest the purchase of many new lamps. Consequently, simple adapter units, shades, reflector bowls and appropriate wattage are the stock in trade. The customer, after hearing the story of light, may, if she chooses, make immediate purchases, or she is asked to go to her favorite dealer with the prescription booklet, which tells the dealer exactly what is wanted. Salesmen will be checked by the actual amount of merchandise that goes from the dealers' shelves.

Here is a program, then, that makes three important contributions to the company: First, it increases energy use with customers who are on higher steps of the rate. Second, it does a real service to customers by way of home beautification at small cost. Third, the salesperson knows that he has something to do. It keeps the sales force intact.

Faster Production Tempo

[*Continued from page 72*]

His big job now is becoming one of selecting which utility expansion projects are vital to keep systems functioning and to meet defense loads and of arranging adequate priorities to insure these deliveries.

One decision which Krug has made on this point is to speed the development of Grand Coulee hydro-electric power, to provide a huge reservoir of low-cost energy in one spot for any major new expansion of electro-process facilities the war effort may require. Probably this also means that practically no other generating expansion will go to the Northwest—the Grand Coulee units will eat up all of that portion of capacity which can be allotted to one area.

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Provide dependable anchoring when poles are subjected to unusual strains from storms. Made of tough, certified, rust resistant, malleable iron for extra strength and holding power. Write for new bulletin.

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FAIRFIELD, IOWA

***Specify* LUGS**

Patented Sherman seamless round end lugs available in sizes from 25 to 250 amps. capacity.

***and* TERMINALS**

Every type of terminal you may require available from this single source.

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Write —to the H. B. Sherman Manufacturing Company, Battle Creek, Michigan, for new catalog showing electrical specialties.

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Battle Creek, Michigan

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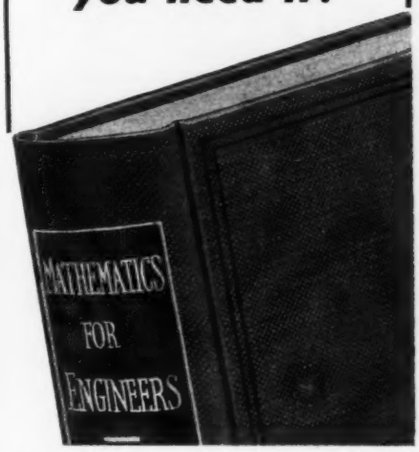

Experience showed Raymond W. Dull that for the practicing engineer a special kind of mathematics book was necessary. Convenience required that he have certain mathematical information available for quick reference. For this reason he prepared his own notes on mathematics in the course of his long engineering practice. At the suggestion of other engineers, Mr. Dull revised and extended his notes and the result of this was

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Fluorescent Popular in Pennsylvania

[*Continued from page 54*]

801 jobs there was a gain of 113 kw.; on another one-third there was no change, and on the final one-third there was a decrease of 111 kw. Thus, the net for the entire 801 jobs was an increase of 2 kw.

Question 7—What is the value to the commercial sales departments in holding and building load with fluorescent lighting?

Answer 7—One company investigated 376 jobs where the salesmen took credit for load sold. These showed that the total net gain for these jobs in actual connected load was 92 kw., but the salesmen claimed that they were responsible for 152 kw. on these jobs, as they feel they were entitled to credit for more load than the actual connected load figures indicate.

This is evidence that the total value of the lighting activities cannot be judged entirely on the basis of actual connected load.

Utility Employees in Anti-Sabotage Army

[*Continued from page 69*]

trained in the proper use of all gas masks normally used in company operations. Established in mid-1940, this force cooperates with the city's police in guarding all system properties.

Because of the large area involved at the company's two gas plants, patrolmen there make their rounds in squad cars with searchlights. Supplementing all these patrolmen are more than 100 uniformed station guards and 21 building attendants, equipped with clubs and police whistles, who patrol dock and yard areas. These men are provided with telephones or automatic alarm devices for summoning help quickly.

•

License Appleton Group

The Appleton (Wis.) Electric League has recently been licensed by the National Adequate Wiring Bureau to certify A.W. installations in homes within the city of Appleton. W. B. Kennedy, of the Wisconsin Michigan Power Co., is chairman of the league's adequate wiring committee. Other members are Louis Luebke, electrical inspector, city of Appleton; A. A. Schneider, Langstadt Electric Co.; Earl Evans, General Electric Supply Corp., and Ted Lang, electrical contractor.

Pulling Cable is Easy! with a Simplex Wire Tensioning Jack

One man and a No. 324 Simplex Tensioning Jack can readily and safely pull overhead and underground cables and take up the slack in guy and transport wires. Rigid rack bar exerts direct pull—quickly hitched, uses standard wire grips and slings. Lever has safety clip—cannot fall out.

The No. 324 is just one of many time-saving, cost-cutting jacks for utilities and electrical contractors—see them all in Bulletin "U-42."

Stocked by leading supply houses.

Templeton, Kenly & Co.
Chicago, Ill.
Better, Safer Jacks Since 1899

Simplex Jacks
dependable and efficient
Lever Type for toe and cap lifting.
Hydraulic for easier cap lifting.
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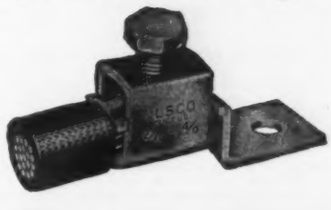

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The advertising rate is $5.50 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.

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NEW ADVERTISEMENTS received by 10 A. M. November 10th will appear in the November 15th issue subject to limitations of space available.

WE WANT ELECTRONIC ENGINEERS AND RADIO TECHNICIANS

Here is an opportunity to serve your country and travel to any point in the United States or possessions at liberal salary and all expenses paid. Employment guaranteed for minimum of one year or longer. Electronic engineers must be graduate electrical engineers with major in Electronics or equal—age 24-30. Radio technicians must be high school graduates with a minimum of four years experience—age 20-30. Single men preferred.

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Write air mail, giving full personal history, personal and experience references, and including snapshot, if possible. Arrangements will be made for personal interview. Address: Chief Engineer,

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Minneapolis, Minnesota

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DRAFTSMEN: Electrical, experienced generating station and substation, Location New York City. State experience and salary desired. P-974, Electrical World, 330 W. 42nd St., New York, N. Y.

EMPLOYMENT SERVICE

SALARIED POSITIONS, $2,500 to $25,000. This thoroughly organized advertising service of 31 years' recognized standing and reputation carries on preliminary negotiations for positions of the calibre indicated above through a procedure individualized to each client's personal requirements. Several weeks are required to negotiate and each individual must finance the moderate cost of his own campaign. Retaining fee protected by a refund provision as stipulated in our agreement. Identity is covered and, if employed, present position protected. If your salary has been $2,500 or more, send only name and address for details. R.W. Bixby, Inc., 262 Delward Bldg., Buffalo, N. Y.

EXECUTIVES AND TECHNICAL MEN, Qualified candidate desiring $2,500 to $20,000 position may contact employers through our confidential services, established 26 years. The National Business Bourse, 20 W. Jackson Blvd., Chicago.

POSITIONS WANTED

(See also "Selling Opportunity Wanted")

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HOLDING COMPANY SALES MANAGER looking for position with operating company. Has both gas and electric experience. Write to PW-966, Electrical World, 520 N. Michigan Ave., Chicago, Ill.

ELECTRICAL ENGINEER, fifty, unmarried, now employed in congenial traveling position; but wishes to change to employment permitting establishment of a home. Thorough training and knowledge of electrical machinery maintenance and operation. Wide experience utility engineering. Recent experience plant electrical engineering layouts. Well read, vigorous, long life expectancy, and able to get along in difficult situations and direct others. History—1912-1917 operation and maintenance of electrical machinery, 1917-1919 U. S. Army, 1919-1920 City Engineering, 1920-1931 from chief draftsman to electrical engineer to first assistant to Engineer, midwest utility, 1931-1934 sickness, 1934-1941 from stationary engineer to maintenance electrician to electrical engineer. Experience spotted; but each time able to learn new professional duties and advance. PW-970, Electrical World, 520 N. Michigan Ave., Chicago, Ill.

POSITIONS WANTED

YOUNG MAN, experienced in operating, maintenance and construction, would like job as switchboard operator in new Power Plant. Address PW-971, Electrical World, 520 N. Michigan Ave., Chicago, Ill.

ELECTRICAL ENGINEER, Superintendent, 20 years diversified experience in Utility Operation, including design, Construction and Operation of Power Plants, Substations, Transmission and Distribution. Familiar with accounting and budget procedure. Now employed. Desire change in location. Rocky Mountain or Midwest preferred. PW-972, Electrical World, 520 N. Michigan Ave., Chicago, Ill.

DISTRIBUTION ENGINEER, ten years experience in progressive design, construction, operation and maintenance of urban and rural systems, desires change for advancement. Age 35, married. Details, training, experience and references on request. Address PW-973, Electrical World, 330 W. 42nd St., New York, N. Y.

SUB-STATION OPERATOR desires change in employment. 14 years with present employer. A.C. and D.C. experience. PW-975, Electrical World, 330 W. 42nd St., New York, N. Y.

SELLING OPPORTUNITIES

OFFERED—WANTED

Selling Agencies—Sales Executives
Salesmen—Additional Lines

OPPORTUNITY WANTED

POWER SALES ENGINEER, BSEE, 14 years utility sales, operation, engineering, one year electrical estimating, desires to negotiate employment with utility or industrial firm. Outline of experience, references on request. Now employed available reasonable notice. SA-976, Electrical World, 520 N. Michigan Ave., Chicago, Ill.

OFFICIAL PROPOSALS

Bids: November 13 (81)

Furnishing Signal and Interlocking Equipment

CITY OF CHICAGO.
STATE STREET SUBWAY.
CONTRACT T-3.

Sealed bids, endorsed "PROPOSAL FOR FURNISHING SIGNAL AND INTERLOCKING EQUIPMENT, CONTRACT T-3," will be received by the City of Chicago, in the County of Cook and State of Illinois, at the office of the Commissioner of Subways and Superhighways, Room 1940, 20 N. Wacker Drive, Chicago, Illinois, until 2 o'clock P.M., Central Standard Time, on Thursday, November 13th, 1941, at which place and time all such proposals will be opened publicly and read aloud by a representative of the Commisioner of Subways and Superhighways.

The work for which such proposals are invited consists of furnishing materials and equipment for an automatic block signal system for the State Street Subway and those portions of the elevated railroad

OFFICIAL PROPOSALS

of the Chicago Rapid Transit Company immediately adjacent to the 2 portals of said subway, complete, with wayside signals, automatic train stops, interlocking equipment and controls, a train identification system and other materials and equipment appurtenant and collateral thereto as specified in the Contract Documents and shown on the plans. The signal system shall be electrically operated throughout or electrically and pneumatically operated throughout, at the option of the bidder, and a bidder may submit a proposal on either or both types of signal systems.

All bids must be made upon blank forms of proposal as furnished by the Commissioner of Subways and Superhighways and included in the Contract Documents, and shall be made in accordance with the provisions contained in said documents.

The Contract Documents, including Standard Specifications for Subway Construction, Contract Requirements and Contract Plans, are on file and available to bidders at the office of the Commissioner of Subways and Superhighways at Room 1940, 20 N. Wacker Drive, Chicago, Illinois. Copies of the Contract Documents may be optained by depositing Twenty-five Dollars ($25.00) with the Commissioner of Subways and Superhighways, for each set of documents. The amount of the deposit for one set of documents will be refunded to each actual bidder who returns the said documents in good condition within ten (10) calendar days after the opening of bids. Fifteen Dollars ($15.00) will be refunded for each of all other sets of documents or returned.

Each proposal must be accompanied by cash or a certified check drawn on some responsible bank doing business in the city of Chicago, in the amount of Twenty Thousand Dollars ($20,000.00) payable to the order of the City of Chicago. A deposit of Twenty Thousand Dollars ($20,000.00) will entitle a bidder to submit a proposal on either the electric signal system or the electro-pneumatic signal system or both. Any proposal submitted without being accompanied by such cash or certified check may be considered informal and consequently may be rejected.

The City of Chicago reserves the right to reject any or all bids and to disregard any informalities in the bids and bidding.

No bid may be withdrawn, after the scheduled closing time for receipt of bids, for at least forty-five (45) calendar days.

CITY OF CHICAGO
By PHILIP HARRINGTON,
Commissioner of Subways and Superhighways

Chicago, Illinois, October 16, 1941.

To Employers Who Advertise for Men . . .

The answers you received to your advertisements are sent with the hope of securing the position offered. Frequently, when there are many applicants, only the most promising letters are acknowledged. The other applicants never know whether their letters reached a prospective employer, or not—and sometimes question their bona fide character. We guarantee that EVERY ADVERTISEMENT PRINTED IN THE SEARCHLIGHT SECTION IS AUTHORIZED.

You can help keep our readers interested—and get better returns to your own advertising in this section—if you acknowledge each reply—in plain envelopes, if you wish.

Departmental Staff—ELECTRICAL WORLD

"Put yourself in the other fellow's place."

J. L. HEMPHILL & CO. Inc.

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1600-1604 53rd Street, North Bergen, N. J.

N. Y. C. Tel.: LOngacre 5-3227—N.J. Tel.: UNion 3-2600

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1—500-KW., 600 volt, General Electric synchronous.
2—300-KW., 250 volt, General Electric synchronous.
1—300-KW., 250 volt, General Electric, slip ring.
1—100-KW., 250 v. Synchronous.
2—50-KW., Westinghouse, squirrel cage, 4000 volt Motor.
1—50-kw., 125-V., G.E., Sq. Cage.
1—50-kw., 250-V., G.E., Sq. Cage.
2—35-kw., 125 volt, Electric Machy., squirrel cage.

TURBINES

8—1000-kw., 2300 volt, condensing.
1—750-KW., 2300 volt, 3 phase, General Electric non-condensing.
1—500-kw., General Electric, 3 phase, 60 cycle, 480 volt bleeder.
1—300-kw., 3 phase, 60 cycle, 220 volt, General Electric, condensing.
1—200-kw., General Electric, condensing.
2—150-kw., Westinghouse, 125/250 v., non-condens.

TRANSFORMERS

1—15,000-kva., Pittsburgh, 3 phase, 26,000/4150 v.
4—833-kva., Allis Chalmers, 25 cycle, 13,200-440 volts.
8—400-kva., Moloney, 13,200-220/440 volts.
4—300-kva., Pittsburgh, 4600/115/230 volts.
4—208-kva., Pittsburgh, 7800/220/110 volts.
5—200-kva., G.E., 4150-230/460 volts.
2—200-kva., General Electric, 2200/220/440 volts.
2—150-kva., Pittsburgh, 6600/440 volts.
2—150-kva., General Electric, 33,000/2300 volts.
18—150-kva., G.E., 3 phase, 4150-120/208 v.
6—100-kva., Wagner, 2200/220-110 volts.
3—75-kva., Pittsburgh, 2400/220/120 volts.
2—50-kva., General Electric, 2200/220/110 volts.
2—50-kva., Kuhlman, 2200/110-220 volts.
3—37½ kva., General Electric, 2400/240/120 V.
3—25-kva., Westinghouse, 440/220-220/110 volts.

MOTORS—3 PHASE, 60 CYCLE

No.	H.P.	R.P.M.	Volts	Type
1	720	360	440	G.E. Syn.
1	500	450	2300/4000	G.E. Sl. Rg.
1	400	514	440	West. Sl. Rg.
1	350	300	440	G.E. Sl. Rg.
1	350	100	220	G.E. Syn.
2	335	600	2200	G.E. Syn.
1	250	450	440	G.E. Sl. Rg.
1	200	514	4000	G.E. Syn.

VARIABLE SPEED 230 VOLT MOTORS

H.P.	R.P.M.	Type
1—150	300/900	Westinghouse
90	470/940	G.E.
75	235/950	Burke
35	500/1500	G.E.
30	600/1200	West
25	300/1200	G.E.
4— 20	400/1200	G.E.
3— 15	300/1200	G.E.

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3	333	G.E.	1	H-KDH	2200–440
3	333	Pitts.	1	OISC	13200–440
3	250	Moloney	1	C	13800–440/220
3	200	G.E.	1	HKDD	13200–575

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2—1000 KW, GE, 250, Gen. to 1400 HP, 10000 v. syn. motor.
1—500 KW, G.E., 600 Gen. to 700 HP, 13200 v. syn. motor with exciter.
1—400 KW, G.E., 275 Gen. to 600 HP, 2300 v. syn. motor with exciter.

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